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Department of Land Records and Agriculture,
N.-W. Provinces and Oudh.

FIELD AND GARDEN CROPS

OF THE

NORTH-WESTERN PROVINCES AND OUDH,

WITH ILLUSTRATIONS.

PART III.

BY

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PREFACE.

THE first part of this work published in 1882, and the second in the following year, contain nearly all the field crops and the more important of those which are usually found in native gardens. The plants referred to in this, the third and concluding part, are, with few exceptions, garden crops, grown in comparatively small patches, and mostly for home consumption.

My acknowledgments are due to Mr. T. W. Holderness, C.S., lately Director of Land Records and Agriculture, who kindly allowed me to consult the agricultural records in the Statistical Office at Cawnpore, and enabled me also to obtain from some of the leading zamindars of these Provinces many interesting facts regarding some of the crops mentioned in this part. Mir Ali Hussain, lately Overseer of the Cawnpore Experimental Farm, has contributed much local information concerning the minor crops.

Since the publication of the second part of this work, five volumes of Dr. Watt's most useful "Dictionary of the Economic Products of India" have appeared; also Professor Church's "Food Grains of India." Both these publications have been freely consulted and made use of in the preparation of this volume.

J. F. DUTHIE.

BENGAL SECRETARIAT

A CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS OF THE N.-W. PROVINCES AND OUDH.

		Part.	Page.	Plate.
I.—FOOD CROPS.				
A. CEREALS—				
Rabi or winter, ..	Avena sativa, (Oats).	I.	13	III.
	Hordeum vulgare, (Barley).	I.	9	II.
	Triticum sativum, (Wheat).	I.	1	Ia. Ib.
Kharif or summer,	Eleusine Coracana, (Mandua).	II.	10	XXVIII.
	Oryza sativa, (Rice).	I.	15	IV.
	Panicum frumentaceum, (Sáwan). ..	II.	3	XXIV.
	Panicum miliaceum,* (Chena). ..	II.	1	XXIII.
	Panicum miliare, (Mijhri).	II.	7	XXVI.
	Paspalum scrobiculatum, (Kodon). ..	II.	8	XXVII.
	Pennisetum typhoideum,† (Bájra). ..	I.	30	VII.
	Setaria italica, (Kangni).	II.	5	XXV.
	Sorghum vulgare,‡ (Juár).	I.	25	VI.
	Zea Mays, (Indian corn).	I.	21	V.
B. VEGETABLES—				
(*a*). *Pulse.*				
Rabi or winter, ..	Cicer arietinum, (Chana).	I.	33	VIII.
	Ervum Lens,§	II.	13	XXXI.
	Lathyrus sativus, (Kasári).	II.	15	XXXII.
	Pisum arvense, (Desi mattar).	II.	17	XXXIIb.
	Pisum sativum, (Gol mattar).	II.	17	XXXIIa.
	Vicia Faba, (Bákla).	III.	4	

* Chena is, more strictly speaking, a hot weather crop in the plains.

† This name is now adopted by botanists as being more correct than that of *Penicillaria spicata*.

‡ Dr. Hackel, in his recently published monograph on the *Andropogoneæ*, includes all the Sorghums under the genus Andropogon.

§ This plant is now referred to under the name of *Lens esculenta*.

CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS—(*continued*).

		Part.	Page.	Plate.
B. VEGETABLES—*(continued).*				
Kharif or summer,	Cajanus indicus, (Arhar).	II.	20	XXXIII. XXXIV.
	Canavalia ensiformis, (Bara sem).	III.	1	LXXI.
	Cyamopois psoralioides, (Guár). ..	II.	24	XXXV.
	Dolichos Lablab, (Sem).	II.	23	XXXIVA. XXXIVB.
	Phaseolus aconitifolius, (Moth). ..	I.	41	XI.
	Phaseolus Mungo, (Mung).	I.	37	IX.
	Phaseolus radiatus, (Urd).	I.	39	X.
	Vigna Catiang, (Lobia).	II.	12	XXIX. XXX.
Himalayan and Tarai,	Dolichos biflorus, (Khulti).	III.	2	LXXXI.
	Glycine hispida, (Bhat).	III.	3	LXXXV.
	Phaseolus multiflorus, (Scarlet runner). ..	III.	4	
	Phaseolus torosus, (Guránsh).	III.	4	
	Phaseolus vulgaris, (French bean).	III.	4	
(*b*). *Root Vegetables*—				
Allium Cepa, (Onion).		III.	5	LXV.
Amorphophallus campanulatus, (Zamin qand).		III.	6	LXIX.
Brassica campestris, Sulsp. Rapa, (Turnip).		III.	7	
Colocasia antiquorum, (Ghuiyán).		III.	8	LXXV.
Daucus Carota, (Carrot).		III.	9	LXXVIII.
Dioscorea globosa, (Chupri álu).		III.	11	
Dioscorea sativa, (Ratálu).		III.	11	LXXX.
Ipomœa Batatas, (Shakkar qand).		III.	12	LXXXVII. LXXXVIII.
Raphanus sativus, (Radish).		III.	14	XCIV.
Solanum tuberosum, (Potato).		III.	15	XCVII.
(*c*). *Ságs*, (used as spinach).				
Amarantus Blitum, *var.* oleraceus.		III.	18	
Amarantus gangeticus, (Chaulai).		III.	17	LXVII.
Basella rubra, (Poi).		III.	19	

CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS—(*continued*).

	Part.	Page.	Plate.
B. VEGETABLES—(*concluded*).			
(*c*). *Ságs*—(concluded).			
Beta bengalensis, (Pálak).	III.	19	LXX.
Brassica oleracea, (Cabbage).	III.	20	
Chenopodium album, (Báthua).	III.	21	
Phytolacca acinosa,	III.	21	
Portulaca oleracea, (Kulfa).	III.	22	XCIII.
(*d*). *Gourds*—			
Benincasa cerifera, (White gourd melon).	II.	43	XLV.
Cephalandra indica, (Bimb).	III.	22	
Citrullus vulgaris, *var.* fistulosus, (Tendu).	II.	46	XLVII.
Cucumis Melo, *var.* Momordica, (Kachra or phunt).	II.	50	XLIX.
Cucumis Melo, *var.* utilissimus, (Kakri).	II.	55	LIII. LIV.
Cucumis sativus, (Khira).	II.	53	LI. LII.
Cucurbita moschata, (Musk melon).	II.	58	LVIII. LIX. LX. LXI.
Lagenaria vulgaris, (Kaddu).	II.	48	XLVIII.
Luffa acutangula, (Káli taroi).	II.	60	LXII.
Luffa, ægyptiaca, (Ghiya taroi).	II.	61	LXIII.
Momordica Charantia, (Karela).	II.	62	LXIV.
Trichosanthes anguina, (Chachinda).	II.	45	XLVI.
Trichosanthes dioica, (Palwal).	III.	23	
C. MISCELLANEOUS FOOD PLANTS—			
Amarantus paniculatus, (Chua-márs).	III.	23	LXVIII.
Amarantus caudatus, (Rámdána).	III.	24	LXVIIIA.
Fagopyrum esculentum, (Buckwheat, ogal).	III.	25	LXXXIII.
Fagopyrum tataricum, (Pháphra).	III.	26	LXXXIV.
Fagopyrum tataricum, *var.*,	III.	27	XCVI.
Solanum Melongena, (Brinjal, baigan).	III.	31	XCV.
Trapa bispinosa, (Singhára).	III.	32	XCVIII.

CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS—(*continued*).

	Part.	Page.	Plate.
C.—MISCELLANEOUS FOOD PLANTS—(*concluded*).			
Hibiscus esculentus, (Bhindi).	III.	29	LXXXVI.
Hibiscus Sabdariffa, (Patwa).	III.	30	
Lycopersicum esculentum, (Tomato).	III.	30	
Fragaria vesca, (Strawberry).	III.	28	
Maranta arundinacea, (Arrowroot).	III.	13	
D.—FOOD ADJUNCTS*—			
Allium sativum, (Garlic).	III.	34	LXVI.
Ammomum subulatum, (Cardamom).	III.	35	
Capsicum annuum,	III.	36	
Capsicum frutescens,	III.	36	LXXIV.
Capsicum minimum, (Bird's-eye chilly).	III.	37	LXXII.
Carum Carui, (Carraway).	III.	38	
Carum copticum, (Ajwain).	III.	38	LXXIII.
Carum Roxburghianum, (Ajmud).	III.	39	
Coriandrum sativum, (Dhanya).	III.	40	LXXVI.
Cuminum Cyminum, (Sufed zira).	III.	40	
Curcuma longa, (Haldi).	III.	41	LXXVII.
Fœniculum vulgare, (Sonf).	III.	43	LXXXII.
Nasturtium officinale, (Water-cress).	III.	44	
Oxalis corniculata, (Chalmori).	III.	44	
Perilla ocymoides, (Bhanjira).	III.	45	
Peucedanum graveolens, (Dill, sowa).	III.	45	XC.
Rumex vesicarius, (Chuko).	III.	45	
Saccharum officinarum, (Sugarcane).	I.	55	XIV.
Trigonella Fœnum-græcum, (Methi).	III.	46	XCIX.
Zingiber officinale, (Ginger, adrak).	III.	47	C.

* The majority of the plants included in this section are also used medicinally.

CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS—(*continued*).

	Part.	Page.	Plate.
II.—MEDICINAL—			
Cichorium Intybus, (Kasni).	III.	48	LXXIX.
Citrullus Colocynthis, (Indrayan).	II.	57	LVII.
Lepidium sativum, (Hálim).	III.	49	
Mentha sylvestris, Linn.,	III.	49	
Ocimum Basilicum, (Káli tulsi).	III.	50	
Ocimum sanctum, (Tulsi).	III.	50	
Plantago ovata, (Ispaghul).	III.	53	XCII.
Piper Betle, (Pan).	III.	51	XCI.
Ricinus communis, (Arend).	II.	38	XLIII.
Trigonella Fœnum-græcum, (Methi).	III.	46	XCIX.
III.—NARCOTICS—			
Cannabis sativa, (Bhang).	I.	80	XIX. XX.
Nicotiana rustica, (Calcuttia tambaku).	I.	69	XVII.
Nicotiana Tabacum, (Desi tambaku).	I.	69	XVI.
Papaver somniferum, (Opium poppy).	I.	64	XV.
IV.—OIL PLANTS—			
Brassica campestris, *var.* dichotoma, (Káli sarson).	II.	29	XL.
Brassica campestris, *var.* glauca, (Sarson).	II.	28	XXXVII.
Brassica campestris, *var* quadrivalvis,	II.	29	XXXIX.
„ „ „ Toria, (Toriya).	II.	29	XLa.
Brassica campestris, *var.* trilocularis,	II.	28	XXXVIII.
„ juncea, (Rai).	II.	33	XLI.
Eruca sativa, (Duan).	II.	26	XXXVI.
Linum usitatissimum, (Alsi).	II.	40	XLIV.
Ricinus communis, (Castor).	II.	38	XLIII.
Sesamum indicum, (Til).	II.	35	XLII.

CLASSIFIED LIST OF THE FIELD AND GARDEN CROPS—(*concluded*).

	Part.	Page.	Plate.
V.—FIBRES—			
Abroma augusta, ...	III.	58	
Cannabis sativa, ... (Hemp).	I.	80	XIX. XX.
Crotalaria juncea, ... (San).	I.	82	XXI.
Gossypium neglectum,* .. .. (Cotton).	I.	75	XVIII.
Hibiscus cannabinus, ... (Patsan).	I.	86	XXII.
VI.—DYES—			
Carthamus tinctorius, ... (Kusum).	I.	51	XIII.
Curcuma longa, ... (Turmeric).	III.	41	LXXVIII.
Indigofera tinctoria, ... (Indigo).	I	43	XII.
Lawsonia alba, ... (Mehndi).	III.	54	
Morinda tinctoria, ... (Ál).	III.	55	LXXXIX.
VII.—FODDERS—	III.	59	

* For the correct identification of the cotton plant as grown in these Provinces, and represented by Plate XVIII. of Part I., we are indebted to Professor Todaro of Palermo, who published in 1877-78 an important monograph entitled "Relazione sulla cultura dei Cotoni." His conclusions were mainly arrived at by means of observations made during the cultivation of species and varieties of cotton obtained from different parts of the world. As regards the Indian cottons, the results of his experiments appear to show that typical *Gossypium herbaceum* of Linnæus is not cultivated in India, and that the bulk of the cotton, grown in India consists of hybrids. One of these hybrids is his *Gossypium neglectum*, the principal cotton plant of these Provinces; and which he considers to be a form of *G. arboreum*. It differs from this latter by its shorter stature and sub-herbaceous habit the leaves are broader, and with less pointed segments; the flowers are yellow with a purple centre (*G. arboreum* has red flowers) and the ovary terminates in an acute point. Again, under *G. Wightianum*, he describes a plant which he believes to be the source from which all the best kinds of cotton grown on the Bombay side of India are derived, *e.g.*, Hinganghát, &c., and is inclined to think that the original indigenous cotton of India was most nearly related ancestrally to *G. Wightianum*. In support of this view it may be mentioned that the semi-wild cotton of the Punjab and that of Rajputána, where it has assumed a tendency to become scandent, agree in general characters more nearly with *G. Wightianum* than with any other. Dr Watt in his Dictionary article (Vol. IV., p. 8) says:—"There is probably no doubt that, whether recognized as a hybrid or species, "*G. Wightianum* is of the greatest importance to India, even much more so than either *G. herbaceum* or *G. arboreum*, be- "tween which in many of its characteristics it is intermediate. Todaro's experiments would, however, support the theory of "*G. Wightianum* being an independent species."

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PART III.

CANAVALIA ENSIFORMIS, *DC.**

[*Vide* Plate LXXI.]

Sword bean ; bara sem (Hind.) ; **ghalaphul, ghul** (Arab.)

Natural order *Leguminosæ*. A large twining biennial or perennial glabrous herb with trifoliolate leaves. Flowers in racemes, shortly stalked, red or white. Pods 6 to 9 inches long, containing several large seeds, which are usually bright red.

This plant is grown to a large extent in these Provinces, but not as a field crop. It is sown around the edges of fields, and is frequently to be seen climbing on palings as well as over the roofs of native houses. Varieties with pink or white seeds are also grown.

The young pods are cooked by natives, either separately and seasoned with various spices, or with other vegetable substances, such as potato, *brinjal*, *dál*, and various *ságs*. The seeds are much used by Muhammadans as a vegetable eaten with meat. A variety with white seeds is considered to be more wholesome. The young tender pods are used by Europeans as a substitute for French beans.

A preparation of the leaves burnt in mustard oil is used as an ointment.

The negroes in the West Indies sow this plant to mark the boundaries of their plantations, and have a notion that it has a protective influence over their property, hence it is called by them "Overlook."

Explanation of Plate LXXI.

1. Lower portion of pod with one valve removed.
2. Outline of entire pod reduced ½.
3. Vertical section of flower.
4. Flower, showing the standard.

* **References:**—Fl. Br. Ind., II., 195 ; Watt., Dict. Econom. Prod., II., 97 ; Church, Food Grains of India, 144 ; Atkinson, Him. Dist., I., 702. *Dolichos gladiatus*, Jacq ; Roxb., Fl. Ind. (Clarke's Ed.), 559. *C. gladiata*, DC. ; W. & A. Prodr., 253. Rheede Hort. Mal., VIII., t. 44.

DOLICHOS BIFLORUS, *Linn.**

[*Vide* Plate LXXXI.]

Madras gram, horse gram; khulti, khulat (Hind.) ; **gahat** (Kumaun).

Natural order *Leguminosæ*. A downy annual with suberect stems, climbing branches, trifoliolate leaves, oblong pointed leaflets, and yellow flowers. Pods 1½-2 inches, recurved, rather flat, and falcate, 5-6 seeded. Seeds compressed, kidney-shaped, and of a grey colour.

In these Provinces it is grown mostly as a rainy season hill crop up to 7,000 feet. It also occurs in some of the districts near the hills. The beans are eaten chiefly by the poorer classes. It is largely grown in the Punjab, where it is known under a great variety of names. In Central and Southern India it is much more extensively grown. In the Madras Presidency the seed forms the principal article of diet for horses. It is there cultivated as a cold weather crop, and harvested in February. Roxburgh says that in a dry light rich soil it produces 60 fold. A variety with black seeds is also sown. Mr. C. Benson, in his report on the Saidapet Farm, mentions that the crop requires a good deal of lime for maturing seed, otherwise the plant will run to leaf. This tendency has been utilized by means of deep ploughing and manure in the production of good fodder at a moderate cost; and when cut before maturing seed its cultivation is found to improve rather than impoverish the soil.

This plant, wherever grown, is highly valued as a fodder for cattle, and in some parts of the Punjab it is sown in the spring solely for fodder.

Professor Church says that the ash of the beans contains nearly one-third of its weight of phosphoric acid, and that the long continued use of these beans is regarded as injurious.

This plant must not be confounded with *guár (Cyamopsis psoralioides)*, which is also called *khulti* in the Muttra District.

Explanation of Plate LXXXI.

1. Standard.
2. Wing.
3. Keel, portion of.
4. Stamens and pistil.
5. Pod, with portion of one valve removed.

* **References**:—Fl. Br. Ind., II., 210 ; Roxb. Fl. Ind. (Clarke's Ed.), 563 ; Atkinson, Him. Dist., 696 ; Watt, Dict. Econom. Prod., III., 133 ; Church, Food Grains of India, 162. *D. uniflorus*, DC. ; Royle, Ill. Him. Bot., 193 ; Stewart, Punj. Pl., 68 ; W. and A. Prodr., 248.

GLYCINE HISPIDA, *Maxim.**

[*Vide* Plate LXXXV.]

Soy bean or **Japan pea**; **bhat** (N.-W. Himalaya); **kajuwa** (Tarai); **bhatnas, bhatwas** (Nepal and N. Tirhoot).

Natural order *Leguminosæ*. An annual clothed with ferruginous hairs. Stems stout, suberect, or climbing. Leaves trifoliolate, on long petioles. Flowers small, reddish. Pods 2-3 seeded, axillary, linear oblong, recurved, and densely pubescent.

The *Glycine Soja*, under which name the soy bean is described in the Flora of British India, is another species, and has been identified with *G. ussuriensis* of Regel, which grows quite wild in Mandchuria, whereas this plant has nowhere been found as unmistakably wild. M. De Candolle, however, remarks that "known facts and historical and philological probabilities tend to show that the species was wild from Cochin China to the south of Japan and to Java when the ancient inhabitants of this region began to cultivate it at a very remote period, to use it for food in various ways, and to obtain from it varieties of which the number is remarkable, especially in Japan."

In these Provinces its cultivation is confined to the lower slopes of the Himalaya and to a few of the neighbouring plains districts. It is grown in poor soils during the rainy season, and represents a very inferior variety of the Japan pea, which under proper cultivation is a much more robust plant, with broader leaves and larger pods and seeds. M. De Candolle states that it is one of the five plants which the Chinese Emperor Chinnong commanded 4,000 years ago to be sown every year with great solemnity.

The plant affords excellent fodder for all kinds of stock, if harvested before it is fully matured.

From the seed a preparation called *miso* is largely used in China and Japan; and the green pods yield the well known sauce.

Professor Church says that the chemical composition of the soy bean entitles it "to the highest place even amongst the pulses, as a food capable of supplementing the deficiences of rice and of other eminently starchy grains. Very few vegetable products are so rich as this bean at once in albuminoids and in fat or oil, the former constituent amounting on the average to 35 per cent. and the latter to 19. * * * Potash forms nearly one-half and phosphorus pentoxide one-third of the ash."

Explanation of Plate LXXXV.

1. Pod with portion of one valve removed.
2. Stamens and pistil.
3. } Flower.
6. }
7. }
4. Portion of keel.
5. Wing.

References:—Watt, Dict. Econom. Prod., III., 510. Fl. Br. Ind., II., 184, under *G. Soja*, Sieb. and Zucc.; Church, Food Grains of India, 140. Atkinson, Him. Dist., I., 696. *Soya hispida*, Mœnch., *Dolichos Soja*, Linn.; Roxb. Fl. Ind. (Clarke's Ed.), 563. DC., L'Orig. Pl. Cult., 264.

PHASEOLUS TOROSUS, *Roxb.**

Guraush, guránsh (Kumaun).

Natural order *Leguminosæ*. An erect, hairy, almost branchless annual with trifoliolate leaves. Leaflets oval. Racemes short, congested. Flowers pale yellow, expanding late in the day. Pods reflexed, cylindrical, torose, 6-7 seeded. Seeds smooth, cream-coloured. It is mentioned in the Flora of British India as probably being a cultivated form of *Ph. calcaratus* of Roxburgh.

I have not seen this plant in cultivation, but Atkinson says that it is "grown at a higher elevation than any other pulse (6,500 feet), chiefly in Káli Kumaun, but also in Almora and the Bhagirathi Valley up to 4,500 feet. He also states that there are two varieties, one with red, and the other with cream-coloured seeds. It ripens in October.

The scarlet runner (*Phaseolus multiflorus*, Willd.) and the French haricot or kidney bean (*Ph. vulgaris*, L.) are occasionally grown in native gardens, but chiefly as pot herbs. The latter thrives best on the hills.

VICIA FABA, *Linn.*†

Var. MICROSPERMA.

Bákla, seo-chana (Plains); **chastang, chashtong** (Hills).

Natural order *Leguminosæ*. This is a remarkable acclimatized form of the field bean, from which it differs by its smaller leaflets, smaller pods, and much smaller seeds, which are round, almost black when ripe, and have more the appearance of a large dark-coloured pea. It is also more prolific, a much larger proportion of flowers becoming fertilized than is the case with the English bean.

As far as I have been able to ascertain, this plant is cultivated chiefly in the north-western districts of these Provinces and in Garhwal and Kumaun, where it may be met with up to 8,000 or 9,000 feet. In the Punjab and in Kashmir it is frequently grown, and is mentioned by Stewart and others as an ordinary spring crop. Roxburgh also states that a small smooth brown-seeded variety is found in a cultivated state in Nepal.

The young pods are eaten as a vegetable, and are sold in the Saharanpur bazar at 6 pies per seer.

* **References**:—Fl. Br. Ind., II., 204; Roxb., Fl. Ind. (Clarke's Ed.), 558; Atkinson, Him. Dist., I., 695; Watt, Dict. Econom. Prod., VI., Part I., 186.

† Roxb., Fl. Ind. (Clarke's Ed.), 566; Royle, Ill. Him. Bot., 200; Atkinson, Him. Dist., I., 694; DC., L'Orig. Pl. Cult., 253.

ALLIUM CEPA, *Willd.**

[*Vide* Plate LXV.]

Common onion ; piyáz, piáz, piyáj (Hind.) ; **palándu** (Sans.) ; **basl** (Arab.) ; **gánthi, gandhana** (bulbs) ; **al** (green stalks).

Natural order *Liliaceæ*.

This well-known plant has been cultivated as a vegetable from very ancient times. It is found wild in Afghanistán and Baluchistán, and may be indigenous also in Palestine (De Candolle). It was cultivated in Egypt in the time of Moses; and Herodotus relates that in his time (B.C. 413) there was an inscription on the great pyramid, stating that a sum amounting to 1,600 talents (= about £428,800) had been paid for onions and garlic which had been supplied to the workmen during its erection (Smith, Econ. Dict.)

The onion is cultivated as a cold weather crop all over the Provinces, and is eaten largely either raw or cooked by all classes of natives, except by high-caste Hindus, who fancy they see in it a resemblance to the inner portion of a bull's navel. It is usually cooked as an ingredient of curry, and is also pickled.

Two acclimatized varieties are commonly grown in native gardens, the white and the red. The seed is sown in September and October at the rate of one seer per acre. Onion seed loses its vitality within a year, hence imported seed often fails to germinate. Onions are sold in the bazar at 10 annas to one rupee a maund.

The medicinal properties of the onion are well-known to natives. When cholera is prevalent, they often carry about with them pieces of onion, or hang them up at the doorways of their houses as a disinfectant.

Onions are occasionally given as food to milch cows and buffalos.

Explanation of Plate LXV.

1. Upper portion of scape bearing the flowers.
2. Young head of flowers partially enclosed in spathe-like bract.
3. A single stamen.
4. Vertical section of flower.
5. Flower seen from below.

* **References** :—Roxb.; Fl. Ind. (Clarke's Ed.), 287 ; Watt, Dict. Econom. Prod., I., 169 ; Royle, Ill. Him. Bot., 392 ; Stewart, Punj. Pl., 230 ; Atkinson, Him. Dist., I., 708, 726 ; DC., L'Orig. Pl. Cult., 52.

AMORPHOPHALLUS CAMPANULATUS, *Blume.*[*]

[*Vide* Plate LXIX.]

Telinga potato; zaminqand (*qand* = crystallized sugar); **nagphanni-kand** (Punj.); **ol.** (Beng.); **arsaghna** (Sans.)

Natural order *Aroideæ*. A perennial stemless herb with tuberous roots often 1½ feet in circumference. Leaves one or two, radical, upwards of 3 feet long, on round tapering stalks, the blade large, twice bifid, the divisions outwardly pinnatifid, ultimate segments oblong, acute. Flowers unisexual, and sessile around the middle portion of an erect fleshy spadix, the upper part of which is dark purple, lobed and wrinkled like a dried truffle. Spathe large, leathery, campanulate, about as long as the spadix, greenish purple towards the margin.

This plant is cultivated in small quantities, and chiefly in the districts near the hills. The tuberous root, which is the part eaten, is said to take three years to mature. Further east, in Bengal, where the climate is moister, the tubers are ready for eating after one year. Roxburgh says that a very rich loose soil suits it best, where the swelling of the root meets with little obstruction, for which reason the ground requires to be very well and repeatedly ploughed. The small tuberosities that are found on the larger roots are employed for sets, and are planted in the manner potatos are in England, and at about the same distance from one another.

The root is boiled and seasoned with various spices, or it is made into a pickle with tamarind leaves. It is not eaten by some classes of Hindus on religious grounds. Baden Powell says that it requires to be boiled several times, and also occasionally with lime water, before it is fit to be eaten. In preparing it as a pickle it is cut into little pieces and fried in oil until it becomes of a red colour, and then it is put into vinegar, &c., or in a mixture of mustard seeds ground up with salt, &c., in water or oil. In the Saharanpur bazar the tubers are sold at 2 annas a seer.

Dr. Dymock (in Veg. Mat. Med., p. 1815) describes a preparation of the root of this plant, which is sold in shops under the name of '*madan mast.*' Segments of the tubers are threaded on string and fried in *ghi* with spices and sugar. It is supposed to have restorative powers, and is in much request. Dr. Dymock remarks also that its Sanscrit name *arsaghna* refers to its reputation as a remedy for piles.

Mr. T. N. Mukharji has stated that the plant when dead and dry is greedily eaten by cattle in Bengal, and that householders collect it for their cows.

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[*] **References**:—Watt., Dict. Econom. Prod., I., 215; Wight, Ic., 785; Royle, Ill. Him. Bot., 407; Atkinson, Him. Dist., I., 704; Econom. Prod., N.-W. Prov., Part V., 23. *Arum campanulatum*, Roxb., Fl. Ind. (Clarke's Ed.), 629; Stewart, Punj. Pl., 246; Baden Powell, Punj. Prod., 259.

BRASSICA CAMPESTRIS, *Linn.**

SUBSPECIES RAPA.

Turnip; shalgham, chaukan (Hind.)

Natural order *Cruciferæ*.

An acclimatized variety is very generally grown, and as a vegetable is gaining favour, especially with Muhammadans and those castes of Hindus who have no religious prejudices in regard to the supposed resemblance of the turnip to animal food.

The actual area occupied by turnips in these Provinces cannot be accurately given, as this crop is included under carrots and radishes in the agricultural returns. It is grown by some of the Himalayan villagers up to 12,000 feet. It is sown in the plains between June and September.

In some of the Punjab districts turnips are extensively cultivated as cattle food; and as a dry season is favourable to a good crop, they are highly important to the cultivator when grass and other kinds of fodder are scarce. From the middle of November the turnip leaves are used as fodder, and by the middle of January all the roots are fit for use. In the Multán district the area under turnips in 1882-83 was 35,885 acres, and the cattle receive this food from the middle of November till February. The turnip crop is an important one in the Jhang district, for if the crop fails, or is late, owing to failure of first sowings, the working power of the bullocks is weakened, and the wheat suffers from insufficient watering. The seed is sown broadcast, and the sowings commence in September and go on till November. Three and a half seers of seed are required for one acre. The crop ripens in three months (Gaz. of the Jhang district, p. 111).

The turnip is cooked, boiled or fried, like other vegetables, and seasoned with spices. It also forms an ingredient of curries. It is often pickled with mustard seed and chillies, and the leaves are eaten as *ság*. The bazar rate for turnips in Saharanpur is two seers for 3 pies.

* **References**:—Fl. Br. Ind., I., 156; Roxb. Fl. Ind. (Clarke's Ed.), 497; Watt., Dict. Econom. Prod., I, 523; Atkinson Econom. Prod., N.-W. Prov., V., 13; Him. Dist., I., 702; DC., L'Orig. Pl. Cult., 29.

COLOCASIA ANTIQUORUM, *Schott.**

[*Vide* Plate LXXV.]

Taro; ghuiyan, arbi, arwi, gagli, kachálu (Hind.); **kachu** (Sans.)

Natural order *Aroideæ*. Stems reduced to a thick farinaceous corm. Leaves peltate, cordate ovate. Flowering stem shorter than the leaf-stalks. Spathe exceeding the spadix, cylindric, erect.

Roxburgh describes five varieties, two cultivated and three wild. It is much cultivated in these Provinces for its large carrot-shaped root, which constitutes a very favourite article of food amongst the lower classes. The young leaves are also eaten, but they, as well as the roots, require to be well cooked in order to get rid of the acrid juice contained in this plant. Two varieties appear to be grown, *viz.*, *dholi ki gagli*, the white-rooted kind, and *káli ki gagli*, with dark coloured roots. The word *gagli*, strictly speaking, refers to the young offsets, the main root being known as *dendu*. Of the latter a pickle is often made, prepared with chillies, salt, and lime juice, and is sold in the bazars. The bazar rate for the vegetable is about one maund and a half for one rupee. The young leaves are used as *ság* (spinach), and are sometimes mixed with gram flour and cooked. In the Cawnpore district *ghuiyan* is sown in February, and the crop requires constant watering, once every week at least, and also eight weedings. It is not a very paying crop, the average outturn being 50 maunds per acre; it is therefore not very much grown. When it is dug, half a seer of the root is given to the labourer instead of *chabena*. It is a poor tasteless vegetable, and a very indifferent substitute for potatos. (Wright, Mem. Agri. Cawnpore, 64). In the Farukhabad district 999 acres are mentioned in the Gazetteer as occupied by this crop. Batten states that this plant is extensively grown in the Bhábar tract, and that the roots are sold at one rupee per maund.

Dr. Dymock says that the acrid juice of the petioles is a common domestic remedy on account of its styptic and astringent properties. The petiole, or leaf-stalk, is slightly roasted and the juice expressed. The tubers chopped up fine and heated are used as a fomentation in rheumatism.

According to Mr. T. N. Mukharji, the roots, cut into small pieces and boiled, either alone or with rice ends, or with plants of *Amarantus spinosus*, are used as cattle food in Bengal.

Explanation of Plate LXXV.

1. Vertical section of spathe showing the spadix.
2. Spathe enclosing the spadix.
3. Peltate leaf.
4. Corm, with offsets attached.

References:—Wight, Ic., t. 786; Watt., Dict. Econom. Prod., II., 509; Royle, Ill. Him. Bot., 406; Dymock, Mat. Med. W. Ind., 817; Batten, Statist. Sketch of Kumaun, 28; Atkinson, Econom. Prod., N.-W. Prov., V., 24; Him Dist., I., 704, 733; DC., L'Orig. Pl. Cult., 58. *Arum Colocasia*, Willd.; Roxb., Fl. Ind. (Clarke's Ed.), 624; Stewart, Punj. Pl., 247. Wright, Mem. Agri. Cawnpore, 64.

DAUCUS CAROTA, *Linn.**

[*Vide* Plate LXXVIII.]

Carrot; gájar (Hind.); **mor muj, bal muj** (Kashmir); **garjara** (Sans.); **jazar** (Arab.); **gazar, zardak** (Pers.)

Natural order *Umbelliferæ.*

A common wild plant in parts of Europe, extending through Western Asia to Kashmir, and along the main Himalayan ranges within the temperate zone. The object of those who cultivate this plant in Europe is to develop a tender well-flavoured root; whilst the chief aim of the Indian cultivator is to produce bulk. Very excellent carrots are, nevertheless, obtainable in this country from annually imported seed. The carrot grown by natives for their own use has a greenish-white root, coarse and flavourless. This acclimatized variety, however, is hardy and prolific, and on this account has proved of inestimable value as a quickly obtainable food-crop in times of scarcity.

The area occupied by carrots is not separately calculated in the agricultural returns of these Provinces, but the following figures show the average area in acres under carrots, turnips, and radishes in the several Divisions for the three years ending 1889-90:—

		Acres.
N.-W. Provinces.		
Agra, ...		13,130
Meerut, ...		9,270
Allahabad, ...		5,698
Benares, ...		3,093
Rohilkhand, ...		2,014
Jhansi, ...		447
Kumaun (Tarai), ...		35
Total, ...		33,687
Oudh.		
Lucknow, ...		4,357
Rae Bareli, ...		1,958
Sitapur, ...		933
Fyzabad, ...		528
Total, ...		7,776
Grand Total, ...		41,463

The carrot crop is generally sown in September or October, and the roots are ready for use after two months, and they will last for three or four months. A loamy soil is preferable. In a good soil and climate an outturn of over 200 maunds is possible.

* **References**:—Fl. Br. Ind., II., 718; Boiss., Fl. Or., II., 1076; Roxb., Fl. Ind. (Clarke's Ed.), 270; Watt, Dict. Econom. Prod., III., 43; Bent. and Trimen, Med. Pl., 135; Pharmacogr. Ind., II., 134; Stewart, Punj. Pl., 105; Atkinson, Econom. Prod., N.-W. Prov., V., 18; Him. Dist., I., 703, 735.

At Cawnpore 60 maunds is said to be the average, and at Basti only 33 maunds. The average bazar rate in ordinary seasons is from 8 to 16 seers for an anna.

The root is eaten either raw, or boiled and seasoned with various spices; or it is cooked with milk and sugar, or *gúr;* it is also pickled. The pickle is prepared by boiling the roots and adding salt, mustard seed, and chillies, and it will keep good for one or two months. The roots are sometimes dried and ground into flour, and eaten with milk or whey. They call this preparation *gájar bhat* in Saharanpur. Many high-class Hindus will not eat carrots, because of the supposed resemblance of the inner hard portion of the root to bone.

In many districts carrots are given as food to cattle and horses, either raw or cooked; and the leaves and tops are highly valued as fodder, especially in seasons of drought. Mr. Crooke says that carrot leaves when used as fodder are known by the names *gajarra, gajraut,* and *gajra.* The great utility of the carrot, sown as a famine crop, was officially indicated by Sir Edward Buck in 1878. The extended cultivation of this plant during the autumn of 1877, on the failure of the previous kharif crop, became, when subjected to statistical investigation, a marked feature in the agricultural operations of the N.-W. Provinces of that year, more especially in the northern and western districts, where the effects of the continued drought were most severely felt. Both carrots and radishes can be quickly and successfully raised by sowing them in September or October; they will then become available as a supplementary food at the most critical period following a failure of the kharif crops. It was ascertained by Sir Edward Buck in 1878 that in some of the upper districts the cultivation of carrots rose to three or four times the ordinary extent, and would have further increased had seeds been obtainable. The price of seed rose from 7 to 40 rupees a maund; and in some instances to a very much higher rate, especially in the central doáb, where the prices ranged above Rs. 50. The acclimatized seed is more suited for this purpose than imported seed, as it gives both quicker and larger returns. Sir Edward Buck says he was informed that in 1869 (a year of scarcity) the Rohilkhand population first took the idea of growing carrots as an emergent crop from the cultivators on the Meerut side. In a report drawn up by Mr. T. N. Mukharji, under Sir E. Buck's direction, the advantages of carrot cultivation in times of scarcity are thus enumerated:—

1. The large amount of food that can be produced on a small area.
2. That cattle as well as men can be fed on carrots.
3. That carrots will maintain a man in health, if supplemented by small quantities of grain.
4. It saves the ryots from the hands of baniyás, who will not take carrots in lieu of money payment.

The seeds are employed medicinally as a stimulant diuretic.

Explanation of Plate LXXVIII.

1. Portion of involucre in flower.
2. „ „ fruit.
3. Flower seen from below.
4. Flower seen from above.
5. Fruit.

DIOSCOREA SATIVA, *Willd.**

[*Vide* Plate LXXX.]

Yam; ratálu (Hind.)

Natural order *Dioscoreaceæ*. A climbing herbaceous perennial with long tuberous roots, and ovate cordate acuminate leaves. On the stems are often found small globular tubers like those of *D. bulbifera*, a common wild species.

This is the commonest species, and is cultivated over the greater part of India. The tubers are planted out in May and June, and are dug up every three years. A variety is largely grown in Delhi, which is said to ripen after one year. In Cawnpore the sowing of two maunds of tubers yields 200 maunds. In the Hardoi district yams fetch Rs. 50 an acre near towns.

The tubers are boiled or fried, and eaten as a vegetable seasoned with spices. It is sometimes pickled. The leaves are also eaten and are cooked separately.

Explanation of Plate LXXX.

1. Outline of tuberous root. | 2. Section of ditto.

DIOSCOREA GLOBOSA, *Roxb.*†

Chupri álu (Hind.)

Natural order *Dioscoreaceæ*. A perennial herb with large roundish white tubers. Stems twining, 6-winged. Leaves alternate and opposite, sagittate cordate.

Roxburgh says that its tubers are the most esteemed of all the yams. According to Atkinson, it is grown in these Provinces, and flowers in the middle of the rainy season. The tubers are large, roundish, and white inside, and the skin thin and smooth like a potato, and when baked are pleasant even to European tastes. The fruit is also edible. It is planted in June and dug up in February.

* **References**:—Fl. Br. Ind., VI., 295; Wight, Ic. t. 878; Watt, Dict. Econom. Prod., III., 133; Stewart, Punj. Pl., 229; DC., L'Orig. Pl. Cult., 61.

† Fl. Br. Ind., VI., 296; Roxb., Fl. Ind. (Clarke's Ed.), 727; Wight, Ic., 812; Atkinson, Econom. Prod., N.-W. Prov. V., 21; Him. Dist., I., 703.

IPOMÆA BATATAS, *Lamk.**

[*Vide* Plates LXXXVII. and LXXXVIII.]

Sweet potato; shakkarqand, ganji, mita álu (Hind.)

Natural order *Convolvulaceæ*. A glabrous or slightly hairy herb with large tuberous roots and creeping stems. Leaves ovate, cordate, acute, angular or lobed. Peduncle long, bearing many campanulate reddish-purple and white flowers.

The sweet potato is a native of South America. Two varieties are extensively cultivated as garden crops in these Provinces, *viz.*, the red-rooted kind and the one with shorter, white roots; the former is said to be sweeter and less stringy than the other, and therefore fetches a higher price in the market. There is also a kind with yellow coloured roots, which is said to be superior to either. In the Saharanpur district a fourth kind, also with yellowish tubers, is recognized as a distinct variety; this, I have reason to believe, is the New Zealand *kumeraho (Ipomæa chrysorhiza)*.† At Saharanpur the bazar rate for the red kind is 2 annas a seer, the other kinds may be purchased at half that sum. The red one is grown in sandy soil by the Jumna near Jagádri and Buriah. The root cuttings are planted out in August, and by the end of November or beginning of December the tubers are ready for use. In other parts of the Provinces the cuttings are put in earlier in the season, and are ready for digging in October. Mr. Wright, in his Memorandum on the Agriculture of Cawnpore, says that *shakkarqand* "is often exchanged for an equal weight of grain, but sells at Re. 1 per maund. Being dug early it can be followed by a crop of *chena* or some vegetable. The cultivator can make, if he pays for labour, Rs. 15 an acre profit, unless the rent taken is very high." It is extensively grown in the Farukhabad district.

This vegetable is eaten by all classes, either roasted or fried by itself, or cooked in curries. Its flour is sometimes made into cakes *(puri)*, or mixed with sweetmeat and cooked in *ghi*, a preparation known by the name of *gulgola*. The young leaves and tender shoots are eaten like spinach; and the foliage is considered excellent food for cattle.

This plant was known in England as the 'potato' before the discovery of what we now know under that name. In the "Merry Wives of Windsor," the words "Let the sky rain potatoes and hail kissing comfits" referred to the sweet potato, which was prepared as a conserve.

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* **References**:—Fl. Br. Ind., IV., 202; Watt, Dict. Econom. Prod., IV., 478. *Convolvulus Batatas*, Linn.; Roxb., Fl. Ind. (Clarke's Ed.), 162; Yule and Burnell, Gloss., 672. *Batatas edulis*, Chois.; Royle, Ill. Him. Bot., 308; Stewart, Punj. Pl., 150; Wright, Mem. Agri. Cawnpore, 64; Atkinson, Econom. Prod., N.-W. Prov., V., 19; Him. Dist., I., 703; DC., L'Orig. Pl. Cult., 42; Rheede, Hort. Mal., VII., t. 50; Rumph., Herb. Amb., V., t. 131.

† A small supply of the roots of this superior yellow-rooted kind was received from the Royal Gardens at Kew in 1883 for experimental cultivation in the Government Garden at Saharanpur. The plant thrived well, and has since found its way into the gardens of native cultivators in this district.

MARANTA ARUNDINACEA, *Linn.**

Arrowroot.

Natural order *Scitamineæ.*

An American plant, largely grown in the West Indies, on which account it is usually known by the name of West Indian Arrowroot. The word 'arrowroot' was originally given to another species, *Maranta Galangal*, the fresh juice from the rhizomes of which was used by the Mexican Indian as an antidote to their arrow poison.

Dr. Jameson, writing from Saharanpur, says: "It grows well throughout the N.-W. Provinces. The tubers are ready in January, which is the best month for preparing the powder." Some arrowroot prepared by Mr. Frazer at Haldwani, below Naini Tal, was considered by experts to be equal to the best West Indian arrowroot.

For the successful cultivation of this plant a good rich friable soil is required and plenty of irrigation except at the time when the tubers are ripening. The tubers are planted in May, in drills, and earthed up like potatoes.

Arrowroot should be a profitable crop in some of the Tarai districts.

East Indian arrowroot is yielded by *Curcuma angustifolia*, which is found wild at low elevations on the Himalaya as well as in Central and Southern India, where the arrowroot-like starch is largely prepared and exported. Roxburgh (quoting Colebrooke) says that this starch is sold in Benares and eaten by the natives. Dr. Dymock states that it is a favourite article of diet, especially for children, and that the milkmen in Bombay use it to thicken milk which has been watered.

* **References**:—Watt, Dict. Econom. Prod., V., 180; Atkinson, Econom. Prod., N.-W. Prov., V., 25; Bent. and Trimen, Med. Pl., 265; DC., L'Orig. Pl. Cult., 64.

RAPHANUS SATIVUS, *Linn.**

[*Vide* Plate XCIV.]

Radish; muli, mula, mura, murl (Hind.) ; **mulaka** (Sans.)

Natural order *Cruciferæ.*

De Candolle says: "It (the radish) appears to have come originally from W. Asia between Palestine, Anatolia, and the Caucasus, perhaps also from Greece, its cultivation spreading east and west from a very early period."

The Indian radish is a good example of what can be done in the way of developing size at the expense of quality. As usually grown in these Provinces it has a long, coarse, pale-coloured root, of which only about half is covered by the soil. It is cultivated extensively, but to what extent in acres cannot be stated, as the area it occupies is included under carrots and turnips in the annual agricultural returns.

It is sown in August and September and is ready for use in October and November, *i.e.*, a little earlier than carrots. The roots are eaten raw or cooked, and are sometimes pickled. The leaves as well as the young seed pods *(singra)* are boiled and eaten as a vegetable.

The radish, like the carrot, is a useful crop to fall back upon in times of scarcity, as it is easily grown and quickly gives a large return. The price of radish seed rose very high in 1877, but the area under this crop was much less than in the case of carrots.

The seeds and the juice of the fresh leaves are used medicinally.

The English radish, when grown to perfection, is not reckoned to be a very wholesome kind of food, but the *muli* of this country, judging from the following proverbs, would appear to bear a still more evil reputation :—

"If a man eats *mula*, or radish, on the 4th (day of the lunar fortnight) his wealth decreases." —*N. Indian Notes and Queries, No.* 38.

"Eat radishes, drink buttermilk and tank water ; these are the ways to get fever to stay with you."—*Crooke's Glossary.*

"Eat bitter melons in Kuár, radishes in Sávan, and coarse sugar in Chait, this is the way to spend your money and buy an illness for yourself."—*Crooke's Glossary.*

Explanation of Plate XCIV.

1. A single leaf.
2. Vertical section of flower.
3. Fruiting branch.
4. Vertical section of fruit.

* **References**:—Fl. Br. Ind., I., 166 ; Roxb., Fl. Ind. (Clarke's Ed.), 500 ; Watt, Dict. Econom. Prod., VI., Part I., 393 ; Stewart, Punj. Pl., 15 ; Atkinson, Econom. Prod., N.-W. Prov., V., 13 ; Him. Dist., I., 702, 748 ; Pharmacogr. Ind., I., 129 ; DC., L'Orig Pl. Cult., 23.

SOLANUM TUBEROSUM, *Linn.**

[*Vide* Plate XCVII.]

Potato; álu.

Natural order *Solanaceæ.*

Historical and botanical investigations point to Chili as the original home of the potato. De Candolle says that it is very doubtful whether its natural home extends to Peru and New Granada. It was introduced to the United States during the latter half of the 16th century, and was imported into Europe between 1580 and 1585, first by the Spaniards, and afterwards by the English, at the time of Raleigh's voyages to Virginia. According to Dr. Ainslie the potato came to India originally from the Cape of Good Hope. Its cultivation on the hills north of Dehra was first started by Major Young, at which time Mussoorie was indicated on maps under the name of the "Potato Garden." The quality was afterwards improved by Captain Townsend, and about the year 1839 potato cultivation became general both in the plains and on the hills. The hill varieties, known usually under the name of "Naini Tál," are largely exported to the plains, and are ready for use some time before the plains varieties come into the market.

This "Naini Tál" kind is also grown in many places in the plains, but requires to be renewed periodically by fresh seed to maintain its quality. The ordinary *desi* potato is a small round kind, red *(lálri)* or white *(Madrasi)*. This and the "Naini Tál" variety can with proper care be kept sound throughout the year. In the Farukhabad district a variety called *satu* is much grown, but it does not keep.

The average area occupied by potatos in these Provinces during the three years ending 1889-90 is represented in the agricultural returns by ·2 per cent. on the *rabi* and *zaid* area and by ·1 on the total area. It is grown chiefly in the vicinity of large towns. In the neighbourhood of Cawnpore the cultivation of this crop was largely extended by the importation by Mr. (now Sir Edward) Buck of *káchhi* cultivators, or market gardeners, from Farukhabad. The cultivation, Mr. Wright says, is on the European method; the ground is heavily manured, and after as many ploughings as possible, ridges are made, and the eyes are dibbled into the ridges about six inches apart. The plants have to be watered two or three times a month according to the weather. Two hundred maunds is not an extraordinary outturn, but the cultivation is very expensive. The eyes are planted in November, and the potatoes are ready for digging up in February. They are sold in the bazar at the rate of 12 annas to one rupee and four annas per maund. In other places the price is much higher.

* **References**:—Royle, Ill. Him. Bot., 708, 750; DC., L'Orig. Pl. Cult., 36; Atkinson, Himl. Dist., 703, 750; Econom. Prod., V., 19; Wright, Mem. Agri. Cawnpore, 64.

Mr. Gollan tells me that the best time to sow the acclimatized varieties is from the middle of September to the middle of October, and that the hill kinds and those imported from Europe must be sown later. Water is freely given during growth, but the quantity is reduced when the leaves begin to turn yellow. On the hills the sets are planted out in February and March. If the soil is naturally rich manure is not essential, but in the plains manure is always given.

The following account of potato cultivation in the Farukhabad district is taken from the Gazetteer of that district, p. 46 :—

"As the first of two yearly crops, maize is followed by opium or barley; but when a third "crop is expected, by potatoes. When the last cob has been cut, and the last stalk removed to be "eaten by the cattle, the roots are dug up and the field is manured for potatoes. Brought in carts "or on bullocks, and thrown down in small heaps about eight or ten yards apart, the manure is at "length spread over the surface. The quantity depends very much on the purchasing ability of "the cultivator. But an average weight of about 30 tons an acre, and an average cost of about "Rs. 50, is a fair estimate. This manure consists of the sweepings of the town or village, but is "often supplemented by other refuse, such as indigo seed.

"Manuring completed, the field is ploughed three or four times—a laborious process, which "occupies some two days and a half per acre. The surface of the field is next levelled with the "patela or clod-crusher; and this done, is divided into a number of beds called *pahal* or *kiári*."

* * * * * *

"The potatoes used for seed are planted along the tops of the ridges, the object of those ridges "being to allow the water to reach the root of the plant without rising above it. The quantity of "seed varies from 5 to 7 maunds an acre, and its price ranges from Rs. 5 to 7 a maund. The "seed potatoes are sown whole, and not cut up as in England. The sowing, a lengthy process, is "of course done by hand. About 23 men are required to sow an acre in one day. Between the "sowings and the ripening of the crop but two operations are needed, irrigation and dressing the "ridges. Potatoes need a large amount of water, and are grown at a time when there is usually "but little rain. Hence they receive from seven to eleven irrigations, nine being the most "common number. To irrigate an acre will occupy some four days only. The shortness of the "process is due to the fact that the ground is never suffered to dry, and that its droughts are "therefore shorter. The ridges in which the potatoes have been sown gradually subside during "the course of irrigation, and the roots, growing larger, become exposed. It is then necessary to "heap fresh earth on them, and this is done three times. The labour increases as the plants, grow-"ing higher, require more earth to be thrown up. At the first dressing 15 men will suffice to "complete the process for an acre field in one day. But the second dressing calls for 20, and "the third 25 men. These operations continue till the middle of January, when in some years "the potatoes are ready to be dug up; but in others the ripening is delayed till the end of the "following month. It requires about 20 persons to dig an acre of potatoes, women and boys being "generally employed for the purpose. The amount of the produce depends almost entirely on the "quantity and strength of the manure employed. In eighteen experiments by Mr. Evans the "produce per acre varied between 115 and 247 maunds, the average being 160. The value, too, "differs somewhat from year to year. The price sunk, for instance, from Re. 1-3-6 in 1869 to "Re. 0-9-0 in 1873. It will be seen, then, that it is very difficult to calculate the profits of a "potato crop. If the whole cost of the manure—the most important item in the expenditure—be "debited to the potatoes, and their market-price happens to be low, the net balance will be very "little, if anything. But the tobacco that follows and the maize crop that preceded, being grown "on the same land without requiring other manure, bring in large profits."

In the Jaunpur district the potato is extensively and successfully cultivated. The crop was introduced originally by Mr. Duncan, Resident of Benares. Land near the town, and which can be easily manured, is selected for the purpose. The kinds most cultivated are the white kidney, the red kidney, and a small round variety, called the *Madrasi*, which has the merit of remaining sound during the greater part of the year.—*Gaz., p. 21.*

The potato has been recommended for cultivation as a famine crop. Sir Edward Buck, in his Report on the use of carrots and other root crops during times of scarcity, mentions that the prices of potatoes for seed went up with a run after the failure of the kharif crop in 1877.

Explanation of Plate XCVII.

1. Flowering branch.
2. Lower portion of stem bearing tubers.
3. A matured potato (nat. size).
4. Section of ditto.
5. Vertical section of flower.
6. Fruit.
7. Section of ditto.

AMARANTUS GANGETICUS, *Linn.**

[*Vide* Plate LXVII.]

Lál ság, chaulai, chamli ság (Hind.); **dengua** (Beng.).

Natural order *Amarantaceæ*. An erect glabrous herb, 2-3 feet high, variously coloured. Leaves 2-5 inches, from linear lanceolate to rounded oval, cuneate at the base. Clusters of flowers crowded in the lower axils and also forming a long terminal spike. Bracts awned, equalling or exceeding the long-awned sepals and the utricle.

Most of the varieties of what is generally known in these Provinces under the name of *chaulai* belong to this species. They do not appear to be very extensively grown, but in Bengal Roxburgh says that the varieties of this useful species are endless, and are in more general use there than any other species; and that they differ from *Amarantus polygamus* and *A. tristis* and their varieties in not admitting of being cut for successive crops, but are pulled up by the roots and carried to market in that state.

In the Cawnpore district *chaulai* is sown in March and is ready for use in the rainy season. The bazar rate is 10 annas per maund. Three kinds are recognized. The leaves and tender stalks are cooked with onions or made into curry.

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* **References**:—Fl. Br. Ind., IV., 719; Roxb., Fl. Ind. (Clarke's Ed.), 662; Watt, Dict. Econom. Prod., I., 212, and III., 304; Church, Food Grains of India, 109; Stewart, Punj. Pl., 181; DC., L'Orig. Pl. Cult., 80. *See* also Roxburgh l.c., pp. 661—668, under *A. tricolor*, Linn.; *A. tristis*, Linn.; and *A. lanceolatus, oleraceus, polygamus*, and *lividus* of Roxb., all of which are synonyms.

Professor Church in his "Food Grains of India," p. 109, thus describes the nutritive value of the seeds of this plant:—

"The analysis shows that we have in these seeds a food in which the proportions, not merely "of albuminoids to total starch, plus the starch equivalent of the oil, but also of the oil itself, are "very nearly those of an ideal or standard ratio."

The following are included as synonyms under *A. gangeticus* in the Flora of British India:—

(1). *A. tristis* of Linnæus Roxburgh says he has never found wild; "it is held in great esteem by all ranks of the natives, and is much cultivated by them; it grows readily all the year round if watered."

(2). *A. lanceolatus*, Roxb., the leaves and tender tips of which are eaten by the natives in their curries, is called '*báns-pata natiya*' (bamboo-leaved amaranth) by the Bengalees.

(3). *A. oleraceus*, Roxb., a variety of which grows from 5–8 feet in rich soil, and the tender succulent tops of the stem and branches are sometimes served up on our tables as a substitute for asparagus (Roxburgh l. c.).

(4). *A. lividus*, Roxb., has bright red stem and petioles, its leaves are dull greenish-purple, with brighter coloured nerves and veins.

Explanation of Plate LXVII.

1. Male flower.
2. Female ditto.
3. Seed (enlarged).
4. „ (nat. size).

AMARANTUS BLITUM, *Linn.**

Var. OLERACEUS.

This plant differs from *A. gangeticus* in having smaller and more obtuse leaves, the bracts and sepals also are much shorter and not awned. It is a cultivated variety of a common wild plant.

It is impossible to say to what extent the plant is grown in these Provinces, as it bears no other distinctive vernacular name than *chaulai*. It is very probable that much of the information given under its botanical name refers to *A. gangeticus*. Atkinson says that it is sometimes grown along the edges of fields in the submontane tract as a pot-herb; and that, like all the amaranths, it is one of the *phaláhas*, or food-grains which Hindus may eat during fasts. He gives as its vernacular name *chamli ság*, which Roxburgh assigns to his *A. polygamus*, which latter is a synonym of *A. gangeticus*, L.

The seed is said to be prepared in various ways, either parched and eaten with milk and sugar, or made into *ladús* (sweetmeat balls).

* References :—Fl. Br. Ind., IV., 721; Watt, Dict Econom. Prod, III., 804; Atkinson, Him. Dist., 697.

BASELLA RUBRA, *Willd.**

Indian spinach; poi, pui, koi, lál bachlu (Hind.); **ban poi** (Beng.)

Natural order *Chenopodiaceæ*. A twining perennial fleshy herb, with broad entire alternate leaves. Flowers white or red, arranged in spikes. It is propagated by seeds or by cuttings, and requires some kind of support on which to climb.

Roxburgh mentions five varieties, two of them found wild and three cultivated; of the latter, one is red, another pale green, and the third is a much more luxuriant kind, which is propagated by cuttings.

This plant appears to be used a good deal in these Provinces as a pot-herb, but not so extensively as in Bengal. At Saharanpur it is mixed with *chana* flour and made into *patour, i.e.*, the above named mixture rolled up in the leaves of *ghuiyan (Colocasia antiquorum)*. It is also cooked separately and with meat, or fried with onions, garlic, and chillies.

It is stated that by eating the *punisak (Basella alba?)* on the 12th (day of the lunar fortnight) a man incurs the guilt of killing a Bráhman.—*N. Indian Notes and Queries, No.* 38.

The plant is used as a cattle fodder in Bengal.

The boiled leaves are used as a poultice, and the juice of the leaves is said to be demulcent and cooling.

BETA BENGALENSIS, *Roxb.*†

[*Vide* Plate LXX.]

Country spinach, or Indian beet; pálak (Hind.); **pálung** (Beng.); **selg, silq** (Arab.); **pálunki** (? Sans.)

Natural order *Chenopodiaceæ*. An annual or perennial succulent herb with erect stems and alternate ovate or oblong nearly entire leaves. Flowers in slender panicled spikes, sessile, usually in pairs.

* **References**:—Fl. Br. Ind., V., 20; Watt, Dict. Econom. Prod., I., 404; Atkinson, Econom. Prod., N.-W. Prov., V., 42; Him. Dist., I., 708. *B. alba*, Linn; Roxb., Fl. Ind. (Clarke's Ed.), 275; Pharmacogr. Ind., III., 148.

† Roxb., Fl. Ind. (Clarke's Ed.), 260. *B. vulgaris*, Linn.; Fl. Br. Ind, V., 5; Boiss., Fl. Or., IV., 898; Stewart, Punj. Pl., 177; Atkinson, Econom. Prod., N.-W. Prov., V., 21; Him. Dist., I., 703. DC., Orig. Cult. Pl., 58. *B. maritima*, Linn.; Watt, Dict. Econom. Prod., I., 448.

Roxburgh says: "I cannot be certain whether this differs from *maritima* so much as to render it a distinct species; however, I think it may, as it always grows erect, and with its numerous branches nearly so." De Candolle, who does not mention the Indian variety by name, traces the origin of the beet-root plant from a slender rooted variety which is found wild, especially near the sea, in the Canary Islands, also along the Mediterranean coasts, and as far as the Caspian sea, Persia, and Babylon.

It is usually sown in the autumn, and is ready for use in December. It is, however, practically obtainable nearly all through the year.

The leaves of this plant are much used in these Provinces as a pot-herb. It is cooked separately, or with meat or with the dál of *múng* or *úrd* and seasoned with various spices, such as onion, garlic, chillies, and *sowa*.

The root is also eaten, but chiefly by Muhammadans. It is recommended as a wholesome food for sick people. The plant is regarded as possessing many healing properties. The root fried in *ghi* and eaten is said to cure *rachaunda*, or night blindness. The fresh leaves are applied to burns and bruises; and the seeds, called *chukandar*, are considered to be cooling and diaphoretic.

Explanation of Plate LXX.

1. } Male flower.
2. }

3. Female ditto.

BRASSICA OLERACEA, *Linn.**

Cabbage; gobhi, karamkalla, bandhi gobhi (Hind.); **gánth (knolkhol).**

Natural order *Cruciferæ*.

The common cabbage, and the numerous very different-looking varieties, such as knolkhol, cauliflower, and Brussels sprouts, which have been developed by cultivation, are all derived from a plant which grows wild on many parts of the coast of W. and S. Europe.

The cauliflower and a coarse kind of cabbage have been successfully acclimatized in native gardens, chiefly in the vicinity of large towns, and are now universally made use of by all classes as an article of food. A good-sized cauliflower may be obtained in the bazars for about one anna.

Cabbage and cauliflower are cooked like ordinary vegetables, either alone or with meat, and seasoned with various spices; they are also pickled.

* **References**:—Roxb., Fl. Ind. (Clarke's Ed.), 497; Watt, Dict. Econom. Prod., 583; Atkinson, Him. Dist., I., 707; DC., L'Orig. Pl. Cult., 66.

CHENOPODIUM ALBUM, *Linn.**

White goosefoot; bathwa, bathu (Hind.)

Natural order *Chenopodiaceæ*. An erect herb usually coated with a mealy substance. Stems and inflorescence often tinged with purple or red. Flowers minute, bisexual, green, arranged in panicled spikes.

A common weed of cultivation all over India, and on the Himalaya up to 12,000 feet, and it is said to occur in Tibet up to 14,000 feet. It is also cultivated. Roxburgh says: "In India we have two varieties of this species, one entirely green, the "other with the angles of the stem and branches of a beautiful purple colour, and the "leaves and mealy panicles somewhat reddish." It is grown by the hillmen as a rainy season crop for its leaves and seeds.

The leaves are eaten as a pot-herb seasoned with various spices, and often mixed with *dál*. The seeds are said to be superior to buck-wheat. The leaves of the wild plant are also collected and cooked as a green vegetable.

Professor Church says that the leaves are rich in mineral matters, particularly in potash salts, and that they also contain a considerable amount of albumenoids and other compounds of nitrogen.

The seeds are used to clean copper vessels preparatory to tinning them.—*Brown in Baden Powell's Punj. Prod., 372.*

PHYTOLACCA ACINOSA, *Roxb.*†

Indian poke; jagrei (Garhwál); **jirrug** (Kumaun).

Natural order *Phytolaccaceæ*. A succulent herb with stout stems 3-5 feet high. Leaves elliptic-ovate or lanceolate acuminate, thinly succulent. Flowers in racemes. Ripe carpels fleshy.

This plant is found wild all along the Himalayas, and is also cultivated up to 10,000 feet for its leaves and fruit, which are cooked and eaten either alone or in curries. In the raw state it possesses powerful narcotic properties which disappear in the cooking of the plant.

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* **References**:—Fl. Br. Ind., V., 3; Roxb., Fl. Ind. (Clarke's Ed.), 260; Boiss., Fl. Or., IV., 901; Watt, Dict. Econom. Prod., II., 265; Atkinson, Econom. Prod., N.-W. Prov., V., 41; Him. Dist., I., 696, 708; Church, Food Grains of India, 109.

† Fl. Br. Ind., V., 21; Roxb., Fl. Ind. (Clarke's Ed.), 389; Watt, Dict. Econom. Prod. VI., Part I., 226; Royle, Ill. Him. Bot., 320; Stewart, Punj. Pl., 176; Atkinson, Econom. Prod., N.-W. Prov., 42; Him. Dist., I., 708.

PORTULACA OLERACEA, *Linn.**

[*Vide* Plate XCIII.]

Garden purslane; kulfa, lunia, lunak (Hind.).

Natural order *Portulaceæ*. A diffuse succulent annual with wedge-shaped leaves and sessile yellow flowers.

This species grows wild in North-Western India. A cultivated variety is grown in many native gardens as a rainy season crop in the plains, and also on the Himalayas up to 7,000 feet.

The young stems and leaves are cooked like spinach with salt and chillies, and are also used in curries.

The fresh leaves which contain oxalate of potash and mucilage are acid, and when bruised are used as a cooling external application in erysipelas, and an infusion of them is given as a diuretic. The seeds are also used in native medicine.

CEPHALANDRA INDICA, *Naud.*†

Bimb, kandwi (Hind.) ; **vimba** (Sans.)

Natural order *Cucurbitaceæ*. A climbing herb with simple tendrils. Leaves 5-angular or lobed, margin toothed. Flowers diœcious, solitary, white. Fruit cylindrical smooth, bright scarlet when ripe.

A common wild plant growing on bushes and in hedges. It is occasionally cultivated in the submontane tracts of these Provinces. Dr. Dymock says that under cultivation the fruit loses its bitterness. The ripe fruit is eaten raw, but is cooked when green and used by the natives in their curries.

The juice of the root and leaves is used medicinally.

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* **References** :—Fl. Br. Ind., I., 246 ; Roxb., Fl. Ind. (Clarke's Ed.), 391 ; Watt, Dict. Econom. Prod., VI., Part 1, 329 ; Dymock, Veg. Mat. Med., 76 ; Royle, Ill. Him. Bot., 221 ; Stewart, Punj. Pl., 99 ; Atkinson, Econom. Prod., N.-W. Prov., V., 89 ; Him. Dist., I., 708, 747 ; DC., L'Orig. Pl. Cult., 69.

† Fl. Br. Ind., II., 621 ; Watt, Dict. Econom. Prod., II., 252 ; Atkinson, Econom. Prod., N.-W. Prov. V., 11 ; Him. Dist., I., 701 ; Pharmacogr. Ind., II., 86. *Momordica monadelpha*, Roxb., Fl. Ind. (Clarke's Ed), 696. *Cocoinia indica*, W. and A.; Royle, Ill. Him. Bot., 218.

TRICHOSANTHES DIOICA, *Roxb.*[*]

Palwal (Hind.).

Natural order *Cucurbitaceæ*. A dicœcious climbing herb with woolly and somewhat scabrous stems ; tendrils bifid ; leaves cordate, oblong, acute. The fruit is about 4 inches long, pointed at either end, and of an orange-red colour.

This small gourd is cultivated to a certain extent in these Provinces. As a wild plant it occurs throughout N. India from the Punjab to E. Bengal. Roxburgh considered it to be the most useful species of *Trichosanthes* with which he was acquainted, and says that it is much cultivated by the natives about Calcutta during the rainy season. In Upper India it is sown from May to July. The plants are allowed to trail along the ground or are supported on trees. Mr. Gollan tells me that trailing plants are considered to bear better fruit. It is generally eaten in curries.

AMARANTUS PANICULATUS, *Linn.*[†]

[*Vide* Plate LXVIII.]

Mársa, chua, chua-mársa, anárdána, báthu (N.-W. Himalaya).

Natural order *Amarantaceæ*. A tall handsome species with stout stems and ovate lanceolate acute or acuminate leaves on long stalks. Flowers densely crowded in long thick squarish red or golden coloured spikes ; bracts and sepals with long awns ; seeds pale yellow, reddish or quite black.

Cultivated during the rainy season in many parts of India, and up to 9,500 feet on the Himalaya, where it becomes a conspicuous feature in the landscape during the autumn months. It is sown in May and June. Atkinson says that the produce of an acre is worth Rs. 16, and that the estimated outlay is about half that sum. The grain is parched, and forms the staple food of the lower classes. It is a favorite crop in newly cleared jungle, and is not easily injured by bears and deer.

Regarding this plant, Madden says :—

"*Anárdána* implies the supposed resemblance of the grains to the carpels of the pomegranate. "I never met any one who used the name, and incline to think '*Amarddna*,' as Dr. Hamilton once

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* References :—Fl. Br. Ind., II., 609 ; Roxb., Fl. Ind. (Clarke's Ed.), 701 ; Atkinson, Him. Dist., I., 699 ; Econom. Prod., N.-W. Prov., V., 4.

† Fl. Br. Ind , IV., 718 ; Church, Food Grains of India, 107. *A. frumentaceus*, Ham. ; Roxb., Fl. Ind. (Clarke's Ed.), 663 ; Atkinson, Him. Dist., I., 697 ; Madden, Trans. Bot. Soc., Edin., (1857) ; DC., L'Orig. Pl. Cult., 282. *A. Anardana*, Ham. ; Watt, Dict. Econom. Prod., I , 210 ; Stewart, Punj. Pl., 181.

"writes it, may be the true one, meaning 'immortal grain,' and therefore nearly identical with Ama-"ranthus: nothing can better answer to the appellation than this species, which is grown all over "the Himalaya. It rises 6 to 8 feet high, and is either of a brilliant crimson or a rich yellow. "The effect of a mountain side, terrace above terrace, covered with distinct fields of these colours "and glowing under the rays of an afternoon sun, is gorgeous indeed; but as an article of food, it "must be confessed the reality falls far below the promise of the eye."

Roxburgh says:—

"First discovered by Dr. Buchanan* on the hills between the Mysore and Coimbatore coun-"tries, where the natives call it '*kiery*,' and cultivate it for the seed, which they convert into flour, "and which forms a great part of their subsistence."

AMARANTUS CAUDATUS, *Linn.*†

[*Vide* Plate LXVIIIA.]

Rámdána and **kedari chua** (Kumaun and Garhwál).

Natural order *Amarantaceæ*.

As a garden plant in England this is known by the name of "Love lies bleeding." It is very similar in many respects to the preceding, of which it may be only a variety. It differs chiefly as to the leaves, the tips of which are obtuse, and in its long pendulous spikes.

It is cultivated on the hills and also in the Tarai. The seed is sown in May-June, and the grain, which is kept for local consumption, is harvested in October.

Explanation of Plate LXVIIIA.

1. Male flower.
2. Female „
3. Seed (enlarged).
4. „ (nat. size).

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* Afterwards known as Dr. Buchanan Hamilton.

† **References**:—Fl. Br. Ind., IV., 719; Boiss., Fl. Or., IV., 988; Atkinson, Him. Dist., I., 697; Madden, Trans. Bot. Soc. Edin., (1856). *Amarantus cruentus*, Willd.; Roxb., Fl. Ind. (Clarke's Ed.), 663.

FAGOPYRUM ESCULENTUM, *Mœnch.**

[*Vide* Plate LXXXIII.]

Common or sweet **buckwheat**; **ogal, ogla, kotu, pháphra** (N.-W. Himalaya).

Natural order *Polygonaceæ*. An erect glabrous annual with triangular, cordate, acute leaves. Flowers many, pink or white, in axillary and terminal cymes. Nut 3-cornered with acute angles, light brown, polished.

According to DeCandolle this plant has been found wild in Manchuria, on the banks of the river Amur, in Dahuria, and near Lake Baikal.

Extensively cultivated on the hills during the rainy season between 4,000 and 10,000 feet. It is sown in July and harvested in October. At the higher elevations the flowers are usually white, like those of *F. tataricum*. The name *ogal* is generally applied to a smaller kind with deep pink flowers, growing between 4,000 and 6,000 feet; and its grain is considered preferable. The grain ground into meal constitutes a staple food in many parts of Kumaun and Garhwal.

Atkinson says that the grain is exported to the plains under the name *kotu*, and is eaten by the Hindus during their fasts. It is said to be heating but palatable, and is sold by the *pansári* or druggists, and not by the general grain dealers. Stewart mentions that the leaves are used in the Punjab as a pot-herb.

The analysis of buckwheat given in Professor Church's "Food Grains of India," was made from a sample obtained in Europe, there being no authentic sample of Indian-grown buckwheat available at the time. In the Kew Bulletin for January 1893, p. 3, he gives the results of an analysis of some ordinary Indian buckwheat received from India last year:—

"100 of the fruits weighed 30 grains. The husk amounted to 18 per cent. by weight."

Composition of Buckwheat (husked).

Water, ...	13·3 per cent.
Albuminoids, ...	14·2 „
Starch, ...	66·6 „
Oil, ...	2·0 „
Fibre, ...	1·9 „
Ash, ...	2·0 „

"The nutrient ratio is here 1 : 5, but when the albuminoids were determined by the phenol

* **References**:—Fl. Br Ind., V., 55; Watt, Dict Econom. Prod., III., 310; Royle, Ill. Him. Bot., 317; Atkinson, Him. Dist., I., 698; Church, Food Grains of India, 114; DC., L'Orig. Pl. Cult, 279. *F. emarginatum*, Meissn.; Stewart, Punj. Pl., 184; *Polygonum Fagopyrum*, Linn; Roxb., Fl. Ind. (Clarke's. Ed.), 335.

"method this ratio becomes 1 : 5½, for the percentage of the albuminoids was reduced to 12·4. "The nutrient value is 85·4.

"On comparing the above percentages with those previously given for the variety *himalaica* "of *F. tataricum*, it will be noted that while the total nutrient value of the latter is higher, its pro- "portion of albuminoids is lower. But, on the other hand the presence of a smaller quantity of "fibre, and of a larger quantity of oil, in the new variety, tells in its favour."

Explanation of Plate LXXXIII.

1. Flower seen from above.
2. „ „ „ below.
3. Vertical section of ditto.
4. Cross section of fruit (enlarged).
5. Fruit (nat. size).

FAGOPYRUM TATARICUM, *Gœrtn.**

[*Vide* Plate LXXXIV.]

Tartarian or bitter buckwheat; phâphra, phâphar (N.-W. Himalaya).

Natural order *Polygonaceæ*. Usually a taller plant than *F. esculentum*. Flowers in peduncled subcapitate cymes, usually white. Nut with three deep grooves, angles rounded, or slightly winged upwards.

This kind of buckwheat is grown to a large extent up to 13,000 or 14,000 feet. The grain is considered inferior to that of *ogal*. It is cultivated and used chiefly for home consumption by the inhabitants of the highly elevated villages. Bears are said to be very fond of this crop. It requires no irrigation, and the yield is 30 to 40 fold.

Explanation of Plate LXXXIV.

1. Flower (enlarged).
2. Vertical section of ditto.
3. Pistil (enlarged).
4. Fruit (nat. size).
5. Cross section of ditto (enlarged).

* **References**:—Fl. Br. Ind., V., 55; Watt., Dict. Econom. Prod, III., 311; Royle, Ill. Him. Bot., 317; Madden Trans. Bot. Soc, (Edin. 1857), p. 406; Atkinson, Him. Dist., I., 698; Church, Food Grains of India, 114; DC., L'Orig Pl. Cult., 281, *F. rotundatum*, Bab.; *Polygonum tataricum*, Linn.; Traill, Stat. Rep. of Kumaun, 64.

FAGOPYRUM TATARICUM, *Gærtn.**

Var. HIMALAICA, *Batalin.*

[*Vide* Plate XCVI.]

The thin dehiscent pericarp of the nut or grain distinguishes this variety from the type. The grain is somewhat smaller, rounder, and of a darker colour.

This variety appears to be restricted to certain parts of the Punjab Himalaya, and is grown to some extent in Kulu. Attention was first drawn to it as a distinct variety in 1888 by Professor A. Batalin, of the Imperial Gardens, St. Petersburgh, who was attracted by the thinness of the pericarp, or shell of the nut, and by the superior quality of the flour. At the request of Dr. Regel, Director of the Imperial Gardens, about one hundredweight of the grain was despatched from Saharanpur to St. Petersburgh for sowing in various parts of Russia.† The common buckwheat is largely cultivated in that country, but the peculiar character of the grain of this new variety was considered likely to render it suitable for the preparation of groats. The climate of Russia has not, however, proved to be favourable for the production of the grain. The plants grew well, attained 2 to 6 feet in height, and gave good crops of fodder, but the yield of grain was insufficient.

In consideration of the superior qualities of the grain of this variety as compared with that of the ordinary high elevation *pháphra* of the Kumaun hills, a fresh supply of seed has been obtained for trial sowings in Kumaun and Garhwál.

The following information contributed by Professor Church regarding this new variety of buckwheat was recently published in the Kew Bulletin :—

"This sample (forwarded from Saharanpur) contained about 8 per cent. of the fruits of the "ordinary form of *F. tataricum;* these were removed, being easily picked out owing to their wide "divergence in colour, texture and form, from the very characteristic fruits of the new variety "which constituted the bulk of the sample.

"In these fruits the pericarp is smooth, dark-coloured, tripartite, invariably dehiscent, and it "does not entirely cover the ripe seed ; it is, moreover, flexible and easily removed. Another "character in which the pericarp of the new variety differs from that of the typical *F. tataricum* is "its relatively small proportion by weight. Thus 100 fruits, weighing 21½ grains, yield no more "than 14 grains of husk against more than twice that amount obtained from the same weight of "fruits of the typical form.

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* **References**:—Kew Bulletin (1891), p. 244 ; (1893), p. 1.

† The consignment was obtained from Kulu through the kindness of the Director of Land Records and Agriculture of the Punjab.

"The seeds of this buckwheat, after separation of the husk, gave, on analysis, the following "results in 100 parts :—

Water, ...	14·2
Albuminoids, ...	12·7
Starch, &c., by difference, ...	67·8
Oil, ...	3·1
Fibre, ...	0·7
Ash, ...	1·5
* * * * * * * * *	

"The nutrient value of these seeds is about 87."

Explanation of Plate XCVI.

1. Flower (enlarged).
2. Vertical section of ditto.
3. Pistil (enlarged).
4. Fruit (nat. size).
5. Cross section of ditto (enlarged).

FRAGARIA VESCA, *Linn.**

Strawberry.

Natural order *Rosaceæ*.

The strawberry has become quite a recognized crop in Northern India, and is now successfully and profitably cultivated in many parts of the plains, especially in the neighbourhood of towns. When first introduced into India its cultivation was confined to the hills, where the fruit ripens during the summer months. In the plains the beds are partially renewed every year with young plants produced from the previous year's runners. The beds must be kept clear of weeds during the rainy season. The fruit ripens between March and May. The wild Himalayan strawberry, referred to *var. nubicola* in the Flora of British India, is abundant at various elevations up to 13,000 feet.

In his Dictionary article on the strawberry Dr. Watt remarks :—

"The earliest obtainable record of successful cultivation in the plains is one in the Trans- "Agri-Hort. Soc. (I., 21) by Dr. Tytler, in which he refers to the plant as growing to perfection "on the banks of the Jumna, near Allahabad."

* **References** :—Fl. Br. Ind., II., 344 ; Watt, Dict. Econom. Prod., III., 349 ; Atkinson, Econom. Prod. N.-W. Prov., V. 69 ; DC., L'Orig. Pl. Cult., 161.

HIBISCUS ESCULENTUS, *Linn.**

[*Vide* Plate LXXXVI.]

Bhindi, bhendi, rám turai, rám taroi (Hind.) ; **bamia** (Egypt.), **bamiya** (Arab. and Pers.) ; **bhinda, bhindaka** (Sans.).

Natural order *Malvaceæ*. A tall erect annual covered with brittle hairs. Leaves scabrous, 3-5 lobed, the lobes oblong and toothed. Bracteoles 8-10, deciduous equalling the spathe-like calyx. Flowers yellow with crimson centre. Capsules subcylindrical, nearly glabrous, containing numerous hairy seeds.

This plant, which is cultivated all over India and in most tropical countries, is supposed to have come originally from Africa. DeCandolle is also of this opinion ; he mentions, however, that it does not appear to have come under cultivation in Lower Egypt before the Arab rule. The Sanscrit names *bhinda* and *bhindaka* are given on the authority of Mr. W. Crooke.

Bhindi is grown universally during the rainy season in native gardens for the sake of its mucilaginous fruit, which is prepared in various ways as food, though occasionally eaten raw. It is cooked either separately, or in the form of curry with meat, and seasoned with various spices. The young pods make a good pickle.

Like most other Malvaceous plants it yields a fibre, which Liotard, in his report on paper-yielding materials of India, mentions as being very fine and well suited for paper-making. He also says that paper has been made of it, though on a small scale, at the Lucknow Central Jail. Dr. Watt says that in France the manufacture of paper from this fibre is the subject of a patent; that it receives only mechanical treatment, and affords a paper called *banda*, equal to that obtained from pure rags.

The mucilage, with which the immature capsules abound, is included amongst the officinal drugs of the Indian Pharmacopœia, and is highly recommended as an emollient and demulcent and as diuretic.

Explanation of Plate LXXXVI.

1. Cross section of fruit.
2. Vertical section of flower.
3. Entire fruit.

* **References**:—Fl. Br. Ind., I., 343 ; Watt, Dict. Econom. Prod., IV., 237 ; Royle, Ill. Him. Bot., 84 ; Atkinson, Econom. Prod. N.-W. Prov., V., 14 ; Him. Dist., I., 702 ; Bent. and Trimen, Med. Pl., 36 ; DC., L'Orig. Pl. Cult., 150 ; *H. longifolius* ; Roxb., Fl. Ind. (Clarke's Ed.), 528 ; *Abelmoschus esculentus*, W. and A. Prod., I., 53 : Stewart, Punj. Pl., 21.

HIBISCUS SABDARIFFA, *Linn.**

Roselle; patwa, lál ambári (Hind.); mesta (Beng.)

Natural order *Malvaceæ*. A small erect glabrous shrub, cultivated in various parts of India for its fleshy, usually bright red edible calyx.

This species is mentioned in the Agra Gazetteer as a food-plant, but it thrives better in Bengal, where the winter cold is less severe. It is sown in April and May, and the plants are put in the ground 3-4 feet apart. By November or December the fleshy calyx is ready for gathering. Firminger says that the most delicious puddings and tarts can be made of it as well as a jelly, which forms an excellent substitute for that of the red currant. A refreshing drink can also be prepared from it.

It is generally regarded as possessing valuable antiscorbutic properties, either fresh or dried. The leaves and seeds are demulcent.

LYCOPERSICUM ESCULENTUM, *Mill.*†

Tomato, or Love-apple; vilayati baigan.

Natural order *Solanaceæ*.

Native country Peru. As an escape from cultivation it is frequently found apparently wild. This vegetable is coming more into favour with natives as an article of food on account of its acid taste. There are several varieties, differing both as to size and shape. In the plains the seed is sown in the autumn, and the fruit is ready for use during the winter months. Excellent tomatos are grown on the hills, where the climate appears to be more suitable for the cultivation of the plant. Mr. Gollan says that by sowing in July and again in September or October, fruit may be had in season in the plains from October to July. During the winter months the crop requires protection from frost.

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* **References**:—Fl. Br. Ind., I., 340; Watt, Dict. Econom. Prod., IV., 243; Atkinson, Econom. Prod., N.-W. Prov., V., 14; Balf. Cycl., II., 45; Firminger, Manual of Gardening (4th Ed.), 209; Pharmacogr. Ind., I., 212.

† Fl. Br. Ind., IV., 237; Roxb., Fl. Ind. (Clarke's Ed.), 190; Watt, Dict. Econom. Prod., V., 100; DC., L'Orig. Pl. Cult., 231. *Solanum Lycopersicum*, Linn.; Stewart, Punj. Pl., 159.

SOLANUM MELONGENA, *Linn.**

[*Vide* Plate XCV.]

Brinjal, mad-apple, or egg-plant; baigan, baingan, bhátá (Hind.) ; **banga, bangana** (Sans.).

Natural order *Solanaceæ*. A perennial herb, prickly or unarmed. Leaves ovate, sinuate, or lobed, clothed beneath with stellate hairs. Flowers bluish, arranged in extra-axillary cymes, usually only the lowest on the cyme becoming fertilized. Fruit or berry round, oval, or elongate-cylindrical.

The original home of this plant has not been ascertained with certainty. According to DeCandolle it is a native of Asia. It has not been found truly wild in India, though often met with as an escape from cultivation, in which condition it becomes much more prickly and more prolific as to the number of fruits. Other authors believe it to be of Arabian origin.

Many varieties of this very useful vegetable are cultivated in these Provinces. They differ chiefly in the shape and size of the fruit. The kinds usually met with in native gardens have oval or cylindrical fruits of a deep purple colour or are variously mottled. *Máru baingan* with long and thick fruits is considered to be the best variety. Another kind called *batiya* has long thin fruits. This latter is probably Roxburgh's *S. longum*.

The seeds are sown at the beginning of the rainy season in ordinary garden soil, and the fruits are ready for use from August and all through the cold weather. On the hills the seed is sown in April and May, and the fruit is obtainable during the autumn months. Although perennial, it is invariably treated as an annual; for, like the capsicums, it is less productive after the first year.

In North-West India Mr. Gollan states that three sowings are made during the year, *viz.*, about the end of October, from the middle of February to the end of March, and early in the rainy season. In October the seed is sown broadcast in beds, and the seedlings have to be protected by grass thatch from the winter cold. They are transplanted about the middle of February into highly manured ground in rows 18 inches apart and 15 inches from plant to plant. The produce of this crop is available from the end of March to the commencement of the rains. The produce of the February sowing is ready for use about the end of May and all through the rainy season, and that of the rainy season sowing is available during the early autumn months. The most prolific

* **References** :—Fl. Br. Ind., IV., 235 ; Roxb., Fl. Ind. (Clarke's Ed.), 190 ; Atkinson, Econom. Prod. N.-W. Prov., V., 20 ; Him. Dist., I., 703, 750 ; Wright, Mem. Agri. Cawnpore, 65 ; DC., L'Orig. Pl. Cult., 229 ; Yule and Burnell, Gloss., 87. *S. insanum* and *longum*, Roxb., Fl. Ind. (Clarke's Ed.), 190, 191. Rheede, Hort. Mal., II., t. 37 ; X., t. 74. Rumph., Herb. Amb., V., tt. 85 and 86.

crop is yielded by the October sowing. Wright, in his "Memorandum on Agriculture in the District of Cawnpore," says :—

"The ground for *baingan* is, if necessary, manured with about 160 maunds per acre, and "ploughed three or four times. It is sown in *Asarh* (*i.e.*, at fall of the rains), 1 lb. seed per acre "being sown in seed beds and the seedlings planted out. The plant is dug up twice and weeded "eight or nine times, and as it occupies the ground the whole year, it is watered every week after "the rain ceases to fall, and *nona* (or saline earth) is applied to the roots. * * * It is much "grown by *kewats (makahs)* on the *kachhár* lands of the Jumna."

Wright gives 17 maunds as the outturn of one acre, and the value at 10 to 12 rupees.

It is used by natives as a vegetable, and is cooked with spices or made into a curry. It is sometimes fried and minced up with buttermilk. A preparation called *bari* or *barya* is made by cooking it with *úrd* dál, with which it is mashed up when wet; this mixture is then separated into small bits and dried in the sun. A pickle is sometimes made of this vegetable. In Saháranpur the bazar rate is one anna per seer. In Cawnpore 2½ seers can be purchased for one anna.

In Gorakhpur the eating of this fruit is said to be inauspicious. This statement may possibly have some reference to the proverb mentioned in "North Indian Notes and Queries," No. 38, where it is said that if brinjal is eaten on the 2nd day of the lunar fortnight, privation of food is the consequence, and if a man eats this vegetable on the 13th day his children are sure to die.

Explanation of Plate XCV.

1. Outline of fruit.
2. Flower.
3. Cross section of fruit.
4. Vertical section of flower.

TRAPA BISPINOSA, *Roxb.**

[*Vide* Plate XCVIII.]

Caltrop or water-chestnut, singhára, páni-phal (Hind.); **gaunri** (Punj.); **shringataka** (Sans.).

Natural order *Onagraceæ*. A floating herb with two kinds of leaves; submerged root-like, pinnatipartite, with filiform segments; the floating ones rostulate, rhomboidal, with a spongy swelling near the apex of the stalk. Flowers axillary, solitary, peduncled, white. Fruit of a brownish colour, bony, 1-celled, obovoid, with four angles, two of which terminate in spines.

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* **References** :—Roxb., Fl. Ind. (Clarke's Ed.), 144: Fl. Br. Ind., II., 590; Atkinson, Econom. Prod., N.-W. Prov., V., 15; Wright, Mem. Agri., Cawnpore, 7 (under *T. natans*); Rheede, Hort. Mal., XI., t. 33.

The following information is given by Atkinson in his "Notes on the Economic Products of the North-Western Provinces," Part V., p. 17:—

"It is cultivated as a favourite food resource in the tanks and fresh-water reservoirs of these "provinces, and is in great request during fasts, being one of the *phaláhas* or fruits lawful for "Hindus to eat during those seasons. It is eaten both raw and cooked, and is also grated into a "flour which, coloured red with *kamila* (the red powder-like substance which covers the fruit of "*Mallotus philippinensis*), is thrown about at the Holi festival. The *singhára* is cultivated chiefly "by Dhimars and Kahars, who have spaces regularly marked out by bamboos, for which they pay "rent to the land-holder. The long stalks reach the surface of the water, on which float the green "leaves, and amongst them the white flowers expand their petals towards evening. In the end of "January the seed or fruit is scattered, at the rate of a maund of 82 lbs. to a local bigha, over the "water where it is sufficiently deep to preclude all chance of its drying up before the advent of the "periodical rains. The seeds are then pressed into the mud with sticks or the feet, and in a "month they begin to throw out shoots. In June, just before the rains set in, the excess is thinned "out and transplanted, the produce of one bigha serving for three or four: the roots are taken "between the great and first toes of the planter's foot and thus fixed in the mud. * * * In "October the nut forms under the water. * * * The fruit is gathered in November and "December. In Hamirpur, in the Mahoba pargana, a local bigha, measured by bamboos 18 feet "long, of which 12 by 2 make the *singhára* bigha, yield three to four maunds of produce, worth "about two to four rupees a maund. The rent is about one to three rupees a bigha, kankar in the "soil being esteemed unfavourable and rich mud fetching the highest rent. The Dhimars of "Hamirpur generally take the lease of a lake at a fixed rent and divide it amongst themselves, their "respective cultivations being marked by upright sticks, the removal of which, as of boundary "marks on shore, leads to many a quarrel. Their great enemy is an insect called *bandu*, which in "both stages of grub and fly feeds on the plant, eating through the husks, and thus destroying the "fruit, which, on being exposed to the water, spoils. The labour of killing these and clearing "away weeds is very great. In Cawnpore a kind of raft is made by joining two earthen vessels "together by a bamboo, astride which, or resting his arms on which, the *kahár* paddles about to "clear off the insects. For the cultivation flat-bottomed canoes are used, scooped out of the trunk "of a single mahwa tree, costing about five rupees each to make, and lasting fifteen to twenty years, "* * * The cultivation of this fruit forms one of the most important sources of the miscella-"neous revenue in villages."

Mr. Wright in his Memorandum on Agriculture in the District of Cawnpore gives also the following information regarding the cultivation of *singhára*:—

"Plants that may have remained in a pond from last year are pulled up and thrown into a pit "or pool of water, where they germinate, and are sold by the owner to purchasers at one maund "per rupee. The purchaser plants his shoots, which increase again, and he then sows as follows: "He prepares 800 pegs as thick as his finger, points them with his sickle, and ties each plant to a "peg with *kus* grass (*Eragrostis cynosuroides*). Floating on a support of two *gharas* (earthen "vessels) upside down joined by a bamboo, he plants out his pegs, diving where it is deep; thirty-"two men would sow an acre in a day. The plant must be examined every day for the purpose "of clearing off the insects. The owner and his friends astride on their rafts float round the ponds "doing this: eight men will manage an acre in a day. * * * On *Deo uthání Ekádashi*, or "five days before the end of Kátik, singháras are eaten and given as offerings. The owner pulls as "many as he wishes for sale, as the nuts continue forming till the end of December, when the plants "rot, the nuts fall, and are dragged out by a primitive drag. * * * About ten maunds an "acre would be a fair outturn, fetching one anna a seer. The singhára plant is so liable to the "ravages of certain insects that in some years the whole crop is a failure."

In the Sháhjahánpur district the rent paid for singhára ponds is said to be as high as that given for an equal area of good cultivated land. It is largely grown in the Farukhabad district.

Singhára flour is much used as food by the Hardwar pilgrims. Mixed with sugar it is known by the name of *phaluda* at Saháranpur. In Kashmir singhára forms a considerable portion of the food of the people. As a food it is regarded as cool and sweet, and is supposed to cure bilious affections and diarrhœa. It is also used for poultices.

In Baden-Powell's "Punjab Products," p. 262, it is stated that green singhára sells at 1 maund and 24 seers per rupee, and dry at 18 seers per rupee. The flour sells at 8 and 10 seers per rupee.

The name of the African lake Tanganyika means the habitat of the singhára nut (N. Ind. Notes and Queries, 37).

Explanation of Plate XCVIII.

1. Vertical section of flower.
2. „ „ of fruit.
3. Entire fruit.

ALLIUM SATIVUM, *Linn.**

[*Vide* Plate LXVI.]

Garlic; lahsan, lasan (Hind.); **som** (Arab.); **mahoushouda** (Sans).

Natural order *Liliaceæ*. A perennial herb. Its true stem, which is much reduced, gives off roots from the base, and supports as cauline appendages the overlapping scales (old leaf bases) which are thickened below and bear in their axils small bulbs or cloves. These closely imbricating scales, together with the cloves and the reduced stem, form the bulb. The flowering stem, or scape, emerges from the centre of the bulb, and bears a few flowers, the majority being replaced by diminutive bulbs.

DeCandolle says, that the only country where the garlic plant has been found in an undoubtedly wild state is the desert of Kirghis of Sungari. He is inclined to think, however, considering the existence of so many Celtic, Slav, Greek, and Latin names,

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* **References**:—Roxb., Fl. Ind. (Clarke's Ed.); Watt, Dict Econom. Prod. I., 172; Stewart, Punj. Pl., 231; Atkinson, Him. Dist., I., 707; Bent. and Trimen, Med. Pl. 280; DC., L'Orig. Pl. Cult., 50.

which differ from the Sanskrit, that its original abode extended much further west, and that possibly certain wild European Alliums, such as *A. arenarium* and *A. scorodoprasum*, may have been used as garlic to which they are closely allied, if not merely varieties.

The cloves are planted in October in drills, and the crop is ready for digging up in the hot weather when the leaves begin to turn yellow. The bulbs are then dried in the sun and stored for future use. They are sold in the bazars at the rate of 16 to 20 seers for the rupee.

Garlic is much used as a spice and for flavouring pickles, chiefly by Mahommedans. It is also employed as a medicine, and is given for fevers, coughs and nervous affections; and in confection for rheumatism. It is applied externally for deafness and pain. It is considered by natives to be hot and aperient.

Explanation of Plate LXVI.

1. Flowering scape in bud.
2. Ditto expanded.
3. Vertical section of flower.
4. Bulblet or clove.
5. Cross section of bulb.

AMOMUM SUBULATUM, *Roxb.*

Greater Cardamom; bari iláchi.

Natural order *citamineæ*. A perennial herb with thick rhizomes supporting leafy branches. The flowering stems (scapes) are leafless, and are terminated by a cone-like spike of flowers. The fruit is about as large as a nutmeg.

This plant is a native of Nepal, and is cultivated in the eastern submontane tracts of these Provinces. The cardamoms are gathered between March and May, and are sold to itinerent merchants, at the rate of about Rs. 12 per maund. The bulk of the produce reaches Patna and Calcutta.

The botanical source of the greater cardamom was first correctly pointed out by Dr. George King.

* **References**:—Fl. Br. Ind, VI., 240; Watt, Dict. Econom. Prod., I., 222; Royle., Ill. Him. Bot., 359; King, in Journ. Linn. Soc., XVII. (1880), 3; Atkinson, Econom. Prod., V., 36. Madden, in Trans. Bot. Soc. Edin. (1857), p. 408.

CAPSICUM ANNUUM, *Linn.**

Red, or pod pepper; lál mirch (Hind.)

Natural order *Solanaceæ*. Annual. Peduncles solitary. Flowers drooping. Fruit 2-3 inches long, reflex, red or yellow.

A native of South America, and probably from Brazil. It is cultivated extensively throughout the plains of India, and on the lower hills up to 6,500 feet. Dr. Stewart remarks that when grown on the hills the fruit becomes more pungent. There are several varieties, differing in the shape and colour of the fruit.

Like many other American productions this plant was no doubt introduced into India by the Portuguese. The dried fruit is largely used by all classes of natives as an ingredient in curries and other food preparations. The green pods are pickled, and when ripe are mixed with tomatos for making sauces for European consumption. As a medicine it is regarded as stomachic and stimulant, and is also used externally as a rubefacient.

CAPSICUM FRUTESCENS, *Linn.*†

[*Vide* Plate LXXIV.]

Cayenne pepper, chillies, spur, or red pepper; mirch (Hind.), **lál gachh** (Beng.), **kursani** (Kumaun).

Natural order *Solanaceæ*. A large shrub-like annual. Pedicels solitary. Fruit pendent, elongate-oblong and tapering at each end, often curved, red orange or yellow.

This plant, which is cultivated all over India, is a comparatively recent introduction from South America. Dr. Watt says, that of the Indian cultivated species this is perhaps the commonest, as it is also the largest, being sometimes cultivated in the hedges

* **References**:—Roxb., Fl. Ind. (Clarke's Ed), 193 ; Watt, Dict. Econom. Prod., II., 134 ; Stewart, Punj. Pl., 156 ; Bent. and Trimen. Med. Pl., 189 ; DC., L'Orig. Pl. Cult., 230.

† Fl. Br. Ind., IV., 239 ; Roxb. Fl. Ind. (Clarke's Ed.), 193 ; Watt., Dict. Econom. Prod., II., 137 ; Royle, Ill. Him. Bot., 280 ; Atkinson, Him. Dist., I., 705, 730 ; Yule and Burnell, Gloss., 150 ; DC., L'Orig. Pl. Cult., 231.

which border the fields. It is grown during the cold season, and thrives best in a light sandy soil. It is largely used by all classes of natives as a condiment. The fruit is sold in the Saháranpur bazars at the rate of 4 annas per seer.

DeCandolle says that the greater part of cayenne pepper is made from this species. Simmonds and other authors, however, give *C. annuum* as the real source.

Roxburgh mentions that in Bengal a pointed variety with yellow or bright orange coloured fruit, and called *gachh murich* by the Hindus, is the kind mostly used, especially when dried, in which state it is found in every market.

CAPSICUM MINIMUM, *Roxb.**

[*Vide* Plate LXXII.]

Bird's-eye chilli.

Natural order *Solanaceæ*. Leaves ovate-cordate. Peduncles in pairs; flowers drooping; calyx with subulate spreading teeth. Fruit subcylindric, erect.

Introduced from South America. This species is cultivated in most parts of India, but not to any great extent. It may be distinguished from *C. annuum* by the more acute corolla lobes, the erect subcylindrical yellow fruit, and its smaller seeds.

Dr. Watt remarks that this small chilli is rarely used by natives, but by Europeans is steeped in vinegar and mixed with salt, and in this form it is employed as a seasoning in stews, chops, &c.

I am inclined to believe that much of the confusion regarding the identification of cultivated capsicums is due to the fact of their constant liability to produce hybrids when different kinds are grown in proximity; and it is quite possible that *Plate* LXXII. represents a hybrid between *C. frutescens* and *C. minimum* with the general habit of the former, and the erect pods of the latter.

Explanation of Plate LXXII.

1. Vertical section of flower.
2. Fruit.
3. Cross section of flower.
4. Seed.

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* **References**:—Fl. Br. Ind., IV., 239; Roxb., Fl. Ind., (Clarke's Ed.), 193; Watt, Dict. Econom. Prod., II., 139; Pharmacogr. Ind., II., 562. *C. fastigiatum*, Blume; Bent. and Trimen, Med. Pl., 1880.

CARUM CARUI, *Linn.**

Caraway; zira, zira siyah (Hind.) ; **jira** (Beng.).

Natural order *Umbelliferæ*. The caraway plant grows wild on the N.-W. Himalaya, and is said to be cultivated in Garhwál for its aromatic fruits. I do not find that it is anywhere grown in the plain districts of these Provinces.

The seeds are used as a spice for flavouring curries and other dishes, and they also form an ingredient of cakes. Medicinally they are regarded as stomachic, carminative and diuretic, and are sometimes used for neuralgia.

There still appears to be some uncertainty regarding the true origin of the various products used as caraway. Dr. Dymock, referring to the ordinary caraway of commerce, remarks :—

"Natives seldom use it, as they have a variety, the *Carum nigrum*, (Vern. *sajira* or *siahzira*,) "which they have long been accustomed to. This, the *C. nigrum*, Royle, has more slender and "darker coloured fruits than the caraway. The flavour approaches that of cummin, and the "Persian name which it bears signifies black cummin. It is probably the article described in "Persian works on Materia Medica as *kirmani*, or black cummin."

According to Bentley and Trimen the name 'Carui' was used by the mediæval pharmacists for the drug, and is said to be derived from the Arabic name 'Karawya,' and that the English word caraway is a further corruption.

CARUM COPTICUM, *Benth.*†

[*Vide* Plate LXXIII.]

Prickly-seeded Bishop's weed, or **Lovage; ajwain, ajowan, bal ajwain** (Hind) ; **yamain** (Sans.).

Natural order *Umbelliferæ*. An annual with finely divided leaves, umbels of white flowers, and muricate subhispid fruits.

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* **References** :—Fl. Ind., II , 680 ; Boiss., Fl. Or., II., 879 ; Watt, Dict. Econom. Prod., II., 196 ; Atkinson, Him. Dist. I., 705, 731 ; Bent. and Trimen, Med. Pl., 121 ; Pharmacogr. Ind., II., 119 ; Dymock, Veg. Mat. Med., W. Ind., 367-8 ; Yule and Burnell, Gloss., 127. *C. nigrum*, Royle, Ill. Him Bot., 220.

† Fl. Br. Ind , II., 682 ; Watt, Dict. Econom. Prod., II., 198 ; Atkinson, Econom. Prod. N.-W. Prov. V., 29 ; Him. Dist., I., 705, 730 ; Pharmacogr. Ind., II., 116. *Amni copticum*, Boiss., Fl. Or., II., 891. *Ligusticum Ajawain*, Fleming, Cat. Ind. Med. Pl., 25. *L. Ajowan*, Roxb., Hort. Beng., 31 ; Fl. Ind., (Clarke's Ed.), 271 ; Stewart, Punj. Pl., 107. *Ptychotis Ajowan*, DC., Wight. Ic., t. 566 ; Royle, Ill. Him. Bot., 229 ; Baden Powell, Punj. Prod., 350. *Carum Ajowan*, Bent. and Trimen, Med. Pl., 120.

It is cultivated in native gardens all over India, the aromatic pungent-tasting seeds being much used both as a medicine and a spice. Medicinally the seeds are used as a remedy for indigestion, also in catarrh, and for rheumatism and colic. Waring says that the seeds are considered to combine the stimulant quality of capsicum or mustard with the bitter property of chiretta, and the antispasmodic virtues of assafœtida. According to Dr. G. Watt it was first mentioned in Europe as having been brought from Egypt about the year 1549. From the seeds has been obtained a crystalline principle similar to menthol.

In the Gazetteer of the Bareilly district, (p. 559,) it is said that a moth (tirha) which attacks the rice plants in that district, is destroyed by the smoke of ajwain kindled in mustard oil.

In the Saháranpur bazar the price per seer is 3 annas.

Explanation of Plate LXXIII.

1. Portion of fruiting umbel.
2. Fruit (enlarged).
3. Vertical section of fruit.
4. } Single flowers (enlarged).
5. }

CARUM ROXBURGHIANUM, *Benth.**

Ajmud, ajmod (Hind.); **ajamoda** (Sans.).

Natural order *Umbelliferæ.*

This plant is cultivated in many native gardens for the sake of its aromatic fruits, which are used as a flavouring ingredient in curries, and also medicinally as a carminative stimulant in dyspepsia. The leaves are made use of by some Europeans in this country as a substitute for parsley, which it somewhat resembles in taste, with, as Dr. Dymock remarks, the additional flavour of anise. It has not been found in a wild state, and Mr. C. B. Clarke says that it is probably a cultivated form of *C. stictocarpum*, a Concan species, which it exactly resembles except as to the fruit, which is hispid.

* **References**:—Fl. Br. Ind., II., 682; Watt, Dict. Econom. Prod., II., 201; Atkinson, Econom. Prod., N.-W. Prov., V., 28; Him. Dist., I., 70*b*; Pharmacogr. Ind., II., 121. *Apium involucratum*, Roxb., Fl. Ind., (Clarke's Ed.), 273. *Ptychotis Roxburghiana*, DC.; Royle, Ill. Him. Bot., 229.

CORIANDRUM SATIVUM, *Linn.**

[*Vide* Plate LXXVI.]

Coriander; dhanya (Hind.) ; **kashniz** (the seeds) ; **dhanyaka** (Sans.).

Natural order *Umbelliferæ*. A smooth much branched annual with decompound leaves and sub-globose fruits.

Dhanya is extensively cultivated in the native gardens of these Provinces for the sake of its fruits and its leaves. The fruits form one of the principal flavouring ingredients of curries, and are also used in confectionery. They are carminative and stomachic, and are sometimes used to cure headache and coughs. Dr. Dymock states that Mahomedans prepare from them an eye-wash supposed to prevent small-pox from destroying the sight, and that coriander is supposed to lessen the intoxicating effects of spirituous preparations. The plant is largely grown in Nepal, and imports from that country regularly figure in the reports of the Basti district. This trade is said to be a very old one. In England, according to Bentley and Trimen, the oil is used in cookery and for flavouring gin, also to correct the griping qualities and bad taste of other medicines. In the Punjab it is said to be grown in every district, and is frequently seen in fields in a semi-wild state. The leaves are eaten as a pot herb, and are also used in chutnies. Bentley and Trimen say that it is hardly known in a wild state, though thought to be a native of Greece and of the Caucasian region.

Explanation of Plate LXXVI.

1. Flower.
2. Flower with the petals removed.
3. Fruit.
4. Vertical section of fruit.
5. Horizontal section of fruit.

CUMINUM CYMINUM, *Linn.*†

Cumin; zira, zira sufed (Hind.) ; **kimun** (Arab.) ; **ziraka** (Sans.).

* **References**:—Fl. Br. Ind., II., 717; Roxb., Fl. Ind, (Clarke's Ed.), 272 ; Watt, Dict. Econom. Prod., II., 567 ; Stewart, Punj. Pl., 105 ; Pharmacogr. Ind., II., 129 ; Atkinson, Econom. Prod., N.-W. Prov., V., 29, 43 ; Him. Dist., I., 705, 708, 733 ; Settlement Rep., Kumaun, App., 34 ; Gaz. N.-W. Prov., VI., 509, 702, 784 ; Statist. Account of Aligarh, 376.

† Fl. Br. Ind., II , 718 ; Roxb., Fl. Ind. (Clarke's Ed.), 271 ; Boiss, Fl. Or., II., 1080 ; Watt, Dict. Econom. Prod., II., 642 ; Royle, Ill. Him. Bot., 229 ; Stewart, Punj. Pl., 105 ; Atkinson, Econom. Prod., N.-W. Prov., V., 30 ; Him. Dist., I., 705, 734 ; Bent. and Trimen, Med. Pl., 134 ; Pharmacogr. Ind., II., 118.

Natural order *Umbelliferæ*. A slender annual. Leaves twice or thrice 3-partite, fruit cylindric, with the secondary ridges usually hispidulous.

The only statements I can find relating to the cultivation of this plant in these Provinces are in the Gazetteers of the Agra and Farukhabad districts. In the former 353 acres are said to be occupied by this crop, and in the latter district 168 acres. In all probability some other plant must be intended. The fruits are much used, however, both as a spice and as a medicine, and are largely imported from over the North-West frontier. Aitchison says that they are sent from Lahoul *viâ* Kulu. According to Bentley and Trimen this plant is supposed to be a native of some part of Western Asia, but it can hardly be said to be known in a wild state. It has been cultivated from earliest times in the countries bordering the Mediterranean, Malta and Sicily affording the chief supply. It is alluded to in Isaiah, Chap. XXVIII., and Matt., Chap. XXIII.

The fruits resemble those of caraway, but they are larger, and of a paler colour, and on each half fruit there are nine instead of five ridges.

Dr. Dymock states that the fruit is much used by Hindus as a condiment, and that it is regarded as stomachic, carminative and astringent; it is prescribed for chronic diarrhœa and dyspepsia, and is also used externally to allay pain and irritation.

Sufed zira is sold in the Saháranpur bazar at $2\frac{1}{2}$ seers for the rupee.

CURCUMA LONGA, *Roxb.**

[*Vide* Plate LXXVII].

Turmeric; haldi (Hind.); **haridra, nisa** (Sans.).

Natural order *Scitamineæ*. A perennial herbaceous plant with elongated tuberous roots. Flowers yellow, arranged in spikes, each in the axil of a large greenish or purplish red bract. The summit of the spike is composed of the empty bracts which are white tinged with pink.

Dr. Watt, in his Dictionary article on turmeric remarks:—

"Although there is a Sanskrit name for the plant, and also names for it in most of the lang-"uages of India, the suggestion may be offered that it is most probably a Chinese or Cochin-"Chinese species, which may have superseded some of the indigenous Curcumas formerly in use, "and which bore the names now given to this plant, just as the true arrowroot plant is rapidly dis-"placing the indigenous or East Indian species."

Haldi is extensively grown all over India. From the rhizomes is prepared the well-known condiment used chiefly in curries, and a dye is also extracted from them, but it

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* **References**:—Roxb., Fl. Ind. (Clarke's Ed.), 11; Watt, Dict. Econom. Prod., II., 659; Royle, Ill. Him. Bot., 358; Stewart, Punj. Pl., 288; Buck, Econom. Prod, N.-W. Prov., III., 20; Atkinson, Econom. Prod., N.-W. Prov., V., 38; Him. Dist., I., 706, 734, 774; Batten, Stat. Sketch of Kumaun, 28; Bent and Trimen, Med. Pl., 269.

is chiefly grown to be used as a spice. The roots or rhizomes of the dye-yielding kind are much harder and more highly coloured. Atkinson (Him. Dist. I., 706) says:—

"It is grown in large quantities in South Eastern Garhwál and Kumaun and in parts of Dehra "Dún. It forms one of the most important and most profitable of exports from the lower hills, "and is cultivated in jungles where nothing else can be profitably raised, as well as in the Dúns and "Bhábar. It is singularly free from the attacks of wild animals. The tubers are planted in April-"May, and the produce is gathered in November. Major Garstin has estimated the cost of cultivat-"ing one acre of turmeric at Rs. 36, of which one rupee goes for rent, Rs. 5 for sowing, Rs. 3 for "planting out, Rs. 20 for seed, Rs. 4½ for weeding and hoeing, and Rs. 2½ for harvesting. An acre "will produce 30 maunds of root worth Rs. 60, and when cured and dried, weighing about 7½ "maunds, worth Rs. 75. Setting down the cost of curing and drying at Rs. 8, the average net "profits on an acre of turmeric amounts to Rs. 31, and thus justifies its popularity amongst the "hill cultivators."

Roxburgh thus describes its cultivation in Bengal, which is equally applicable to these Provinces:—

"The ground must be rich, friable, and so high as not to be overflowed during the rainy "season, such as the Bengalees about Calcutta call *danga*. It is often planted on land where "sugar-cane grew the preceding year, and is deemed a meliorating crop. The soil must be well "ploughed and cleared of weeds, &c. It is then raised in April and May, according as the rains "begin to fall, into ridges, nine or ten inches high, and eighteen or twenty broad, with interven-"ing trenches nine or ten inches broad. The cuttings or sets, *viz.*, small portions of the fresh root "are planted on the tops of the ridges, at about eighteen inches, or two feet asunder. One acre "requires about from nine hundred such sets, and yields in December and January about two "thousand pounds' weight of the fresh root."

In the Cawnpore district it is grown along with *ghuiyán*, and has to be abundantly irrigated. The cost of cultivating one bigha of land (= $\frac{4}{7}$ acre) has been estimated at Rs. 19; and as the yield of one bigha is four maunds, and the dried roots are sold at Rs. 9 per maund, Rs. 17 remain as profit. The bazar rate at Saháranpur is 3 seers for one rupee.

In the Kheri district, where it is much cultivated, it is planted in almost sandy soil. The roots, after being dug up, are boiled for two days in earthen pots over fires lighted in the fields. It was first cultivated in this district about the year 1865. In 1877 the price per maund of the boiled root was Rs. 10. Before that time the price was Rs. 17. A good crop will yield two thousand pounds (Gaz.).

The following information is taken from Part III. of the Economic Products of the North-Western Provinces, page 21:—

"When dug up the roots are boiled and dried in the sun: in this form they are the turmeric "sold in the Indian bazars. When the dye is to be used, the roots are again boiled and powdered "while wet. A decoction is then made of this paste in water, in which the cloth is well steeped, "being subsequently dried in the shade. In the Kumaun district the roots are soaked in limejuice "and borax before being powdered instead of being boiled."

"The employment of borax in Kumaun," Dr. Watt observes, "will be found to have a very "considerable interest, since the system there pursued, and doubtless accidentally discovered, is de-"pendent on an important chemical feature of the dye principle."

The yellow dye prepared from turmeric is not much used except in combination with other dyes, such as indigo and safflower. It is found to be not a permanent colour, and changes to red in the presence of an alkali.

"As a medicine" Dr. Dymock says "it is applied in skin diseases, and also given inter-"nally. The powder is applied to foul ulcers to clean them. Turmeric paste with the addition of "lime is a popular application to bruises, sprains, wounds, leech bites, &c. * * * "The starch of the young tubers which are nearly colourless, forms one of the East Indian arrow-"roots. It is to be observed that the tubers which yield only starch when young will yield tur-"meric when old, the colouring matter and aromatic principles are deposited in the cells at a later "period of growth; this is the case with almost all the Curcumas which have aromatic and coloured "central tubers."

FŒNICULUM VULGARE, *Gœrtn.**

[*Vide* Plate LXXXII.]

Fennel; sonf, saunf (Hind.); **panmahri** (Beng.); **madhurica** (Sans.).

Natural order *Umbelliferæ*. The form cultivated in India is a tall glabrous annual. The leaves are 2-4 pinnate with the ultimate segments very long. Flowers yellow.

Sonf is extensively cultivated during the cold season in these Provinces in garden patches. The root is used as a purgative, the leaves are eaten as a pot herb, and the fruits are carminative.

Roxburgh, alluding to this Indian variety of fennel under the name Anethum Panmori, says:—

"Like *sowa* is cultivated in various parts of Bengal during the cold season for the seed which "the natives eat with their betel and also in their curries. Seed time about October. Harvest in "March when the plants perish. The seeds possess a warmish, very sweet taste, and aromatic smell, "so much like sweet fennel that I should certainly have thought them but varieties of the same "species if I had not had both growing before me for several years in the Botanic Garden at "Calcutta, where plants of *Anethum Fœniculum* reared from Europe seed do not blossom till the "second year, during which period the leaves are bifarious, infinitely larger and more divided than "in *panmahuree*, which is an annual plant of only 4 or 5 months' duration, with the leaves at all times "scattered, fewer and more remote."

Dr. Dymock says that the Indian fennel fruits are rather smaller and straighter than the European article. Modeen Sheriff points out that this plant and anise have been confounded together in Arabic and Persian works. The root of fennel is rather

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* **References**:—Fl Br. Ind., II., 695; Wight, Ic., t. 515; Watt, Dict. Econom. Prod., III., 405; Stewart, Punj. Pl., 107; Atkinson, Econom. Prod., N.-W. Prov., V., 80; Him. Dist., I., 705, 737; Dymock, Veg. Mat. Med., 372, 737; Pharmacogr. Ind., II., 124; *F. officianāle*, All.; Boiss., Fl. Or., II.. 975, *F. Panmorium*, DC.; Wight, Ic., t. 570; Royle, Ill. Him. Bot., 229. *F. capillaceum*, Gilib., var.; Bent. and Trimen, Med. Pl., 123. *Anethum Panmori*, Roxb., Fl. Ind. (Clarke's Ed.), 272; Fleming, Cat. Med. Pl., 6.

an important medicine in native practice, being to the present day esteemed as one of the five opening roots of the ancients, the others being parsley, wild celery, asparagus, and butcher's broom.

Fennel is said to be grown as a field crop in Khandesh and in parts of the Deccan, and the fruits are exported.

The bazar price in Saháranpur for the fruits is 4 seers for the rupee.

NASTURTIUM OFFICINALE, R. Br.*

Water-cress; piriya halim.

Natural order *Cruciferæ*. An aquatic herb with creeping or floating stems. Leaves pinnate. Flowers white.

Atkinson states that the water-cress is cultivated in Kota and in Dehra Dún. On the Himalayan range it occurs in a semi-wild state, but chiefly near hill stations. It has no doubt been introduced into India. Its properties are antiscorbutic and stimulant, and the eating of it is said to increase the appetite.

OXALIS CORNICULATA, *Linn.*†

Yellow Wood-sorrel; chalmori (Hind.) ; **chuka-tipatti** (Beng.)

Natural order *Geraniaceæ*. A small somewhat hairy annual with trifoliolate leaves and yellow flowers.

A very common weed especially on cultivated ground both in the plains and on the hills up to 8,000 feet or more. According to Atkinson it is occasionally cultivated and used as a salad. It is also cooked and used as a pot herb especially in times of drought.

Modeen Sheriff says that the fresh leaves made into a curry improve the appetite and digestion of dyspeptic patients, and that they are also used as a poultice to produce cold and relieve inflammatory symptoms. Dr. Dymock states that the fresh juice is given to relieve intoxication from datura, also for dysentery.

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* **References** :—Fl. Br. Ind., I., 133 ; Watt, Dict. Econom. Prod., V., 342 ; Royle, Ill. Him. Bot., 70 ; Atkinson, Him. Dist. ,I., 708 ; DC., L'Orig. Pl. Cult., 352.

† Fl. Br. Ind., I., 436 ; Roxb., Fl. Ind. (Clarke's Ed), 389 ; Watt, Dict. Econom. Prod. ; Royle, Ill. Him. Bot., 152 ; Stewart, Punj. Pl., 37 ; Atkinson, Econom. Prod. N.-W. Prov., V., 14 ; Him. Dist., I., 708, 744 ; Phamacogr. Ind., I. 246 ; Dymock, Veg Mat. Med , 121 ; Balf., Cycl., III., 66.

PERILLA OCYMOIDES, *Linn.**

Bhanjira.

Natural order *Labiatæ*. A coarse aromatic hairy herb with ovate toothed leaves and small white flowers.

This plant is abundant on the Himalaya, but chiefly near villages. Atkinson states that it is cultivated for its leaves, and for the culinary oil expressed from its seeds. I have been told also that the seeds are sometimes eaten raw as a medicine.

PEUCEDANUM GRAVEOLENS, *Benth.*†

[*Vide* Plate XC.]

Dill; sowa soya (Hind.); **shubit** (Arab.)

Natural order *Umbelliferæ*. A smooth perennial herb 1-3 feet high. Leaves 2-3 pinnate, the ultimate segments linear. Flowers yellow, in compound umbels.

Occurs wild in tropical and subtropical India, also in the cornfields of South Europe and in West Asia. It is said to have been grown by the Greeks and Romans. The Indian cultivated form differs in having the fruit a little longer and more narrowly winged.

According to Atkinson it is cultivated as a cold weather crop in most of the districts of these Provinces for its fruits, which form an important ingredient in curries. The leaves are also cooked as a pot herb along with other vegetables. The fruit is used medicinally by natives as a warm remedy; also for colic, especially in horses. Dill water, prepared from the fruit, is regarded as stimulant, carminative, and aromatic; and, like anise, is popularly supposed to promote the secretion of milk.

RUMEX VESICARIUS, *Linn.*‡

Bladder dock; chuko, chok, chuka palang (Hind.); **chukra** (Sans.)

* **References**:—Fl. Br. Ind., IV., 646; Watt, Dict. Econom. Prod.; Atkinson, Econom. Prod. N.-W. Prov., V., 42. *Mentha perilloides*, Roxb., Fl. Ind. (Clarke's Ed.), 460.

† Fl. Br. Ind., II. 709; Watt, Dict. Econom. Prod.; Atkinson, Econom. Prod. N.-W. Prov., V., 27; Him. Dist. I., 705, 745; Bent. and Trimen, Med. Pl., 132; Pharmacogr., II., 128. *Anethum graveolens*, Linn., Boiss., Fl. Or., II., 1026; Dymock, Veg. Mat. Med., 374. *A Sowa*, Roxb. Hort. Beng., 22; Fl. Ind. (Clarke's Ed.), 272; Wight, Ic, t. 572; Fleming, Cat. Ind. Med. Pl., 5; Stewart, Punj. Pl., 103.

‡ Fl. Br. Ind, V., 61; Roxb., Fl. Ind., (Clarke's Ed.), 309; Atkinson, Econom. Prod. N.-W. Prov. V., 42; Pharmacogr. Ind., III., 157; Dymock, Veg Mat. Med., 658.

Natural order *Polygonaceæ*. A smooth rather fleshy unisexual annual, with elliptic ovate or oblong leaves. Flowers on short terminal leafless racemes.

Atkinson says :—" Cultivated in beds near wells ; " and, according to Roxburgh, it is found cultivated in gardens all over Asia, and used by the natives in their food as well as medicinally. Dymock states that it is used like sorrel, and much esteemed for its medicinal properties. The juice is said to allay the pain of toothache, it checks nausea, and promotes the appetite. The plant is also regarded as an antidote to scorpion stings, and the roasted seeds are prescribed for dysentery.

TRIGONELLA FŒNUM-GRÆCUM, *Linn.**

[*Vide* Plate XCIX.]

Fenugreek ; methi (Hind.) ; **methika, methini** (Sans.) ; **helbeh** (Arab.).

Natural order *Leguminosæ*. A nearly smooth erect annual with trifoliolate leaves, and pale-yellow pea-shaped flowers. Pods 2-3 inches long, turgid.

This plant is a native of Eastern Europe and Abyssinia. It is extensively cultivated throughout the Mediterranean region, also in Egypt and India.

Grown extensively during the cold season in gardens as a potherb, and occasionally in the North-Western districts of these Provinces as a fodder-crop. The seeds are also used as a spice and medicinally. They are considered to be carminative tonic and demulcent. The leaves in the form of a poultice are applied to burns, and to bring down swellings ; they are said to be useful also in preventing the loss of hair. In the Cawnpore district the leaves after being roasted in an earthern-ware pot closed with mud are said to be very effective for disordered spleen. The plant appears to have been much used by the ancient Egyptions, Greeks, and Romans both as food and medicine. According to Bentley and Trimen the seedling plants are still used as food, and considered a delicacy. The powdered seeds are used to some extent in veterinary practice, also for flavouring certain patented cattle foods, and for rendering palatable damaged hay. The peculiar odour given off from the dried plant is due to the presence of coumarine.

In the Punjab it is largely grown as a fodder plant and given green. The seed is sown at the rate of 16 seers per acre. In the Montgomery district the crop is ploughed in once and after three months, if irrigated, it will afford three cuttings, care being taken to water the crop after each cutting. It is a hardy plant, and not liable to disease.

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* **References** :—Fl. Br. Ind., II., 87 ; Boiss., Fl. Or., II., 70 ; Roxb., Fl. Ind. (Clarke's Ed.) 588 ; Royle, Ill. Him. Bot., 197. ; Atkinson. Him. Dist., I., 708, 752 ; Bent. and Trim., Med. Pl., 71 ; DC., L'Orig. Pl. Cult., 89.

ZINGIBER OFFICINALE, *Roscoe.**

[*Vide* Plate C.]

Ginger; **adrak** (fresh), **sonth** (dried); **ada** (Kumaun); **zingabil, zinjabil** (Arab.); **shanviz** (Pers.); **adraka** and **shringavera** (fresh), **nagara** (dry) (Sans.).

Natural order *Scitamineæ*. A biennial herb with a thick tuberous root-stock. Stems leafy 3-4 feet high. Flowers in spikes, greenish with a small purplish black lip. The plant, however, rarely flowers, and Roxburgh says that he never met with the seeds.

The ginger plant is not known in a wild state, though generally believed to have originated in Tropical Asia, whence it was introduced into the West Indies.

In these Provinces the cultivation of ginger is confined to the Himalayan districts in moist situations up to 4 or 5,000 feet. The tubers are dug up during the months of October and November, and after removing the rind, which is usually done by shaking the tubers up in a basket, they are laid out in the sun to dry, and again shaken. In this condition ginger is called *sonth*.

The following is a description of ginger cultivation in the Hill States adjoining the Umballa district:—The best pieces of last year's harvest are selected, and placed in a corner of the house, and smeared over with cowdung to keep them moist. Pieces of roots 3 inches long are buried in the soil (after two or three ploughings) 9 inches apart, and the whole are covered with leaves, and over the leaves manure is spread half an inch thick. A bigha of land requires 8 maunds of ginger to plant it, and yields 32 maunds for a first-rate crop. Ginger fit for planting again sells at from 8 to 10 seers per rupee, and that for use only at 24 to 32 seers per rupee (Punjab Products, page 299).

Dymock states in his Veg. Mat. Med. of W. Ind., p. 762, that in Sanscrit works ginger is mentioned as one of the three acids (*trikatu*), the other two being black pepper and long pepper.

Explanation of Plate C.

1. Flower spike, ...
2. Single flower, ...
3. Vertical section of ditto, ...
4. Stamen and pistil, ...

} Copied from Bentley and Trimen.

* **References**:—Fl. Br. Ind., VI., 246; Roxb., Fl. Ind. (Clarke's Ed.), 16; Asiat. Res., XI., 345; Royle, Ill. Him. Bot., 358; Stewart, Punj. Pl., 239; Atkinson, Him. Dist. I., 706, 754; Batten, Statist. Sketch of Kumaun (1878), p. 28; Bent and Trim., Med. Pl., 270; Yule and Burnell, Gloss., 286. Porter, Trop. Agriculturist, 317; Smith, Dom. Bot., 171; Rheede, Hort. Mal. XI., 21, t. 12; Rumph., Amboin., V., t. 60, Fig. 1.

CICHORIUM INTYBUS, *Linn.**

[*Vide* Plate LXXIX.]

Chicory or succory; kasni (Hind.); **hindba** (Arab.).

Natural order *Compositæ*. An erect hispid perennial herb with bright blue flowers in terminal or axillary heads.

The chicory plant is a native of Europe, and is also found wild on the North-Western Himalaya from 4 to 11,000 feet. In the plains it occurs plentifully by road-sides and along the borders of cultivated ground, but evidently as an escape from cultivation. In the Kangra district it is cultivated for the sake of the seeds which are alterative; and in some parts of the Punjab the plant is grown for fodder. Roxburgh states that when young the plant is used as a vegetable. In France the young leaves are eaten as salad under the name of '*barbe du capucine*,' and Dr. Watt says that the leaves and roots constitute half of the food of the poorer classes in Egypt. Medicinally it has tonic, demulcent and cooling properties. The root is bitter, and is used in the Punjab as a liver tonic instead of *taraxacum*. *Cichorium Endivia* is the garden endive.

Explanation of Plate LXXIX.

1. Root.
2. Flowering branch.
3. Vertical section of flower head.
4. One of the ray florets (enlarged).
5. Fruit (nat. size).

CURCUMA KUCHOOR, *Royle.*†

Pahári kachur.

Natural order *Scitamineæ*. A tuberous-rooted herbaceous perennial allied to *C. montana*.

Royle in his "Illustrations of Himalayan Botany," p. 359, mentions this plant as being grown on the hills above Dehra Dún. I have seen the plant, but not in flower. It is cultivated in small quantities also in the Kangra Valley along with *haldi* (*C. longa*). The tubers are planted in April, and are ready for digging up in November. They are scalded in boiling water, and then shaken in baskets to remove the fibres and outer skin. The root is pale yellow, aromatic and bitter. As a medicine it is used internally and acts as a carminative. Applied externally in the form of a plaister it is said to cure pains.

* **References**:—Fl. Br. Ind., III., 391; Boiss., Fl. Or., III., 715; Watt, Dict. Econom. Prod., II.; Royle, Ill. Him. Bot., 247; Pharmacogr. Ind., II., 311.

† Fl. Br. Ind., VI., 214; Baden-Powell, Punj. Prod., 300.

LEPIDIUM SATIVUM, *Linn.**

Cress; hálim, hálon, (Hind.) ; half (Arab.) ; halch (Pers.).

Natural order *Cruciferæ.*

Garden cress is grown in patches in almost every native garden in the plains as a cold weather crop. Though often met with as an escape it is not known to be indigenous in India. DeCandolle believes it to be a native of Persia, and to have spread thence into the gardens of India, Syria, Greece, and Egypt, and as far even as Abyssinia. Royle also said :—

" It is probable that it was introduced into India from Cabul or Persia, where also we must look " for the route by which the cabbage, radish, and turnip have found their way into India, as all were " known and cultivated long before they were introduced by Europeans."

The seeds are used as a tonic laxative and antiscorbutic, and as a gentle stimulant in indigestion (Atkinson, Him. Dist.). The leaves are also eaten raw.

MENTHA SYLVESTRIS, *Linn.*†

Mint; Podina, Padina, (Hind.).

Natural order *Labiatæ.* A sweet-scented hoary-tomentose perennial herb with a creeping root-stock. Flowers lilac, in terminal spikes with the whorls more or less interrupted.

This plant is a native of the temperate Himalayan region. It is grown in many native gardens in the plains of India. The leaves, as well as a decoction of the plant, are used as a carminative and stimulant. A preparation of the leaves also forms an ingredient of sauces together with chillies and salt.

Spearmint (*Mentha viridis,* Linn.) is also to be found in many native gardens in the plains, and is known by the name of *pahári padina.* The plant is used as a flavouring ingredient in curries, and the oil is given medicinally as a stimulative and carminative in indigestion and colic, and along with purgatives to prevent griping.

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* **References** :—Fl. Br. Ind., I., 159 ; Roxb., Fl. Ind. (Clarke's Ed.), 497 ; Watt, Dict. Econom. Prod., IV., 627 ; Royle, Ill. Him. Bot., 70 ; Stewart, Punj. Pl., 14 ; Atkinson, Econom. Prod., N.-W. Prov. ; V., 39 ; Him. Dist., I., 702, 740 ; Pharmacogr. Ind. I., 120 ; DC., L'Orig. Pl. Cult., 68.

† Fl. Br. Ind., IV., 647 ; Boiss. Fl. Or., IV., 543 ; Watt, Dict. Econom. Prod , V., 230 ; Dymock, Veg. Mat. Med., 615 ; Atkinson, Him. Dist., I., 815 ; Econom. Prod., N.-W. Prov., V., 18 ; Baden-Powell, Punj. Prod., 365 ; Stewart, Punj. Pl., 169.

OCIMUM BASILICUM, *Linn.**

Common or Sweet Basil; kali tulsi, babui tulsi (Hind.).

Natural order *Labiatæ*. An erect usually hairy strongly scented herbaceous plant frequently met with in the hotter parts of India. There are several varieties, one of which imported from Persia is tinged with purple, another has deeply cut leaves, whilst a third kind is distinguished by its much larger fruiting calyces.

This plant is much cultivated and is used by natives as a flavouring ingredient. The small black seeds when steeped in water swell up and form a kind of jelly which is useful as a diuretic and demulcent.

OCIMUM SANCTUM, *Linn.*†

Sacred Basil; tulsi (Hind.) ; **talasi talasika** (Sans.).

Natural order *Labiatæ*. An erect herb clothed with soft hairs. Flowers in slender racemes. Lower teeth of calyx with long awns. Corolla hardly exceeding the calyx.

This plant is cultivated throughout India and is met with up to 6,000 feet on the Himalaya. Though often occurring in a semi-wild state it is probably not indigenous in this country.

The following allusion to its sacredness is taken from Dr. Watt's Dictionary :—

"The *tulsi* is the most sacred plant in the Hindu religion ; it is consequently found in or near "almost every Hindu house throughout India. Hindu poets say that it protects from misfortune "and sanctifies and guides to heaven all who cultivate it. The Brahmins hold it sacred to the gods "Krishna and Vishnu. The story goes that this plant is the transformed nymph Tulasi, beloved "of Krishna, and for this reason near every Hindu house it is cultivated in pots, or on brick or "earthen pillars with hollows at the top in which earth is deposited ; it is daily watered and "worshipped by all the members of the family. Under favourable circumstances, it grows to a con- "siderable size, and furnishes a woody stem large enough to make beads from for the rosaries used "by Hindus on which they count the number of recitations of their deity's name."

The roots, leaves, and seeds are used medicinally.

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* **References**:—Fl. Br. Ind., IV., 608 ; Watt, Dict., Econom. Prod., V., 440 ; Atkinson, Him. Dist., I., 708 ; Pharmacogr. Ind., III., 83 ; Balf. Cycl. III., 5. *Ocymum Basilicum*, Willd. ; Roxb., Fl. Ind. (Clarke's Ed.), 464. *O. pilosum*, Willd. ; Roxb., I. c. 464. *O. caryophyllatum*, Roxb., l. c., 463.

† Fl. Br. Ind., IV., 609 ; Roxb., Fl. Ind. (Clarke's Ed.), 463 ; Yule and Burnell, Gloss., 709 ; Pharmacogr. Ind., III., 86 ; Watt, Dict. Econom. Prod., V., 444.

PIPER BETEL, *Linn.**

[*Vide* Plates XCI. and XCIA.]

Betel-leaf pepper; **pán** (Hind.); **tanbol** (Arab.); **tambula** (Sans.).

Natural order *Piperaceæ*. A climbing perennial smooth dioecious herb. Leaves alternate large, entire, coriaceous, cordate, obliquely ovate-oblong or rounded, 5-7 nerved. Flowers minute in spikes. Male spikes 3-6 inches. Female spikes on long peduncles, 1-5 inches, stout, pendulous.

This plant is a native of the Indian Archipelago. It is extensively grown in Ceylon and in the moister parts of India.

In these Provinces its cultivation is restricted to the warmer and damper eastern and southern districts. A variety grown in Bundelkhand is in great request in Upper India. Special care has to be taken to protect the plants from wind, and to keep up a continuous degree of moisture within the plantation.

The following account of the cultivation of this plant in the Azamgarh district is taken from the Gazetteer of the North-Western Provinces, Vol. XIII., p. 52:—

"Pán or betel pepper is grown only by the professional cultivators and vendors called Barais. "The lands on which it is grown are called *barej*. It is mostly grown in pargana Máhul, but even "there its cultivation is decreasing. Pán beds are formed upon the banks of old tanks. The best "soil is a clean blackish mouldy clay. A bank having been selected, the ground is dug up to the "depth of 6 or 7 inches and levelled off in even slopes on both sides of the bank. Earth is then "taken from the dry bed of the tank, pounded into dust and laid over the bank 3 or 4 inches deep, "and the whole bank well watered with the hand. A shed is then erected on the bank. It is "usually 6 or 7 feet high and enclosed on all sides. The doors are on the tank side of the bank "and are provided with screens. The supports of the shed are in some places entirely of bamboo, "but in others cuttings of a quick-growing plant (*Euphorbia*), called *pharbat*, are planted round the "bank to form supports. The walls are made thick in order to keep out the wind; but the roof is "thin enough to admit a certain amount of sunlight and to allow rain to pass through gently in "small drops. *Poi* (*Basella*), and other light climbing vegetables are frequently planted inside the "shed. Climbing up they spread over the roof and form part of it. The supports of the shed are "generally called *koro*, the walls *tatti*, the roof *máro*; and the whole conservatory or garden is called "*baraith*. The ground within the *baraith* is divided into strips about 2 feet broad running over "the bank from one side to the other. Each alternate strip, called an *átar*, is planted with *pán*, and "it is by the *átar* that rent, varying from one anna to six per *átar*, is charged by the proprietor of the "land. The vacant strips serve as passages, and are called *pahs* or *pairahs*. *Pán* is planted in the "*átars* in rows (*mur* or *khát*) from four to six rows to the *átar*. It is not raised from seed but from "cuttings. These are cut with three or more joints (*únkh*). They are placed in little furrows and "lightly covered with soil. A layer of thatching grass or rushes is then laid upon the furrow and

* **References**:—Fl. Br. Ind., V., 85; Roxb., Fl. Ind. (Clarke's Ed.). 53; Hunter in As. Res., IX, 390; Royle, Ill. Him. Bot., 332; Yule and Burnell, Gloss., 67; Pharmacogr. Ind., III., 183; Wright, Mem. Agri. Cawnpore, 68. *Chavica Betel*, Miq.; Wight, Ic. t. 2926; Atkinson, Him. Dist, 768; Econom. Prod. N.-W. Prov., V., 32. Rheede, Hort. Mal, VII., 29, t. 15.

" kept damp till the young shoots appear and make a little growth. Planting is done in the spring " (March); the cuttings are generally under grass for a month or more; and from the time of the " removal of the grass till the rains the plant must be regularly and carefully irrigated. Towards " the end of the rains the *átars* are manured with pounded oil-cake, sometimes with pease-meal. " During the cold season irrigation is renewed, but more sparingly than in the hot months. The " plants are trained upon thin supports called *sarai* or *kamaia*. The plant grows from 4 to 7 feet " high. Vines planted in March yield leaves fit for plucking in June or July. *Pán* is plucked all " the year round, but the full-grown plant yields most leaf in the autumn. If properly tended, the " plants last two or three years.

" The leaves when mature bend back and are nipped off with the hand. They are arranged in " packets of fifty called *kaunris*, and four of the latter make a *dholi*. These again are packed in " little baskets of leaves called *gadaukas* or *donas*. The plucked leaves must be kept damp, be " frequently turned, and the little rotten spots in them cut out. In a garden of good healthy " plants, from 50 to a 100 *dholis* of *pán* per *átar*, according to the length of the *átar*, are gathered " in the season. The leaves are sold to Tamolis at rates varying with the season from half an anna " to five annas a *dholi*. *Pán* is very susceptible to frost. It suffers also from blights, and from the " attacks of lice. Several varieties are planted—*sanchi*, *bangalá*, *chakaiyá*, *kapuri*, *kakariá*."

The following information is taken from Wright's " Memorandum on the Agriculture of Cawnpore," p. 68:—The tender shoots from a growing plant are laid flat and covered with wet earth, then with grass, over which water from the pond is sprinkled four times a day. The shoots are planted in rows (*mándha*). In one acre there will be 50 such rows, the space of one cubit being left between each. The young plants, two to five, are trained on to *sentha*, (the stems of the *múnj* grass or *Saccharum ciliare*). These stems are set up in lumps of clay. The young plants are tied on to the *senthas* with *kus* grass (*Eragrostis cynosuroides*). Constant labour is required to rear the plant; it must be watered twice every day till well grown, when once a day is enough; and after the rains every third day. Meanwhile plants of the pumpkin kind are grown over the frame-work to keep the interior cool. During the months of August, September and October the plants are manured with a mixture of flour (*kanak*) and oil-cake. This costs 10½ annas per row. *Pán* is often kept for a long time, and sometimes sells as high as eight leaves per pice. It is stored in baskets of bamboo or of some other grass, each basket containing one *dholi*.

The medicinal properties of *pán* are thus described in U. C. Dutt's Materia Medica of the Hindus—

" The leaves of this creeper are, as is well known, masticated by the natives of India. The " poorer classes make their packets of betel with the addition of lime, catechu, and betel nuts. " The rich add cardamoms, nutmegs, cloves, camphor, and other aromatics. Betel-leaf thus chewed " acts as a gentle stimulant and exhilarant. Those accustomed to its use feel a sense of languor " when deprived of it. Ancient Hindu writers recommend that betel-leaf should be taken early in " the morning, after meals, and at bed-time. According to Susruta, it is aromatic, carminative, " stimulant and astringent. It sweetens the breath, improves the voice, and removes all foulness " from the mouth."

The following terms used in connection with *pán* and its cultivation are taken from Crooke's " Rural and Agricultural Glossary ":—

Bhit or *bhint*, *bhiti* is the mound on which the garden is situated.

Atar or *antar* = the rows; also called *mándha* in Doab and *murh* or *khát* in the Eastern districts.

Pah or *paira* are the intervening passages.

Tatti = the walls.

Manro is the roof.

Bel = the seedlings.

Peri is the name given to the second crop from the same roots.

Kaunri = packet of 50 leaves.

Dholi means a packet of 200 leaves.

A *leso* contains 60 dholi.

Bira, *Biri*, *Gilauri* = the leaf rolled for chewing.

PLANTAGO OVATA, *Forsk.**

[*Vide* Plate XCII.]

Isabghol, isafghol (Hind.); **ispaghul** (Pers.); **bazr-katuma** (Arab.).

Natural order *Plantagineæ*. An almost stemless and more or less villous annual, with linear or filiform leaves. Flowers in cylindrical or ovoid spikes.

This plant is found wild in the Punjab and in Sindh. It is occasionally cultivated in gardens for its seeds which are cooling and demulcent, and are useful in diarrhœa and dysentery. Dr. Dymock says that the crushed seeds made into a poultice with vinegar and oil are applied to rheumatic and gouty swellings, and that with the mucilage a cooling lotion for the head is made. The seeds of *Plantago amplexicaulis* and *ciliata* are sometimes used as substitutes.

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* **References**:—Fl. Br. Ind., IV., 707; Boiss., Fl. Or. IV., 885. *P. Ispaghul*, Roxb., Fl. Ind. (Clarke's Ed.) 135; Fleming, in As. Res., XI., 174; Royle Ill., 312; Bent. and Trim., Med. Pl., 211; Stewart, Punj. Pl., 174; Dymock, Veg. Mat. Med., 648.

LAWSONIA ALBA, *Lamk.**

Henna, or Egyptian privet; mendhi (Hind.)

Natural order *Lythraceæ*. A smooth erect shrub occasionally armed with spines. Leaves opposite, entire, lanceolate. Flowers small, white or rose-coloured, in terminal panicled cymes sweet-scented.

DeCandolle was of opinion that the henna plant originated in Persia, and that its cultivation and use spread from that country into Africa on the west, and eastwards to India.

Mendhi is abundant all over these Provinces as a hedge plant, but there are no statistics to show to what extent it is grown for the sake of its dye. In the Agra *Gazetteer*, p. 448, sixteen acres are mentioned as being occupied by this plant.

In parts of the Punjab *mendhi* is grown as a crop. The following is an account by Major (now Sir William) Davies of its cultivation in Sháhpur:—The soil is prepared by repeated ploughings, not less than sixteen, and heavy manuring. Before sowing, the seed is allowed to soak in water for 25 days. It is then spread on cloth and allowed to dry partially. The plot of land in which it is proposed to grow the *mendhi* is then formed into small beds, and some days before sowing these are kept flooded. The seed is scattered on the surface of the water, and with it sinks into the ground. For the first three days after sowing water is given regularly night and morning, after that only once a day. The young plant first shows above ground on the fifteenth day, after which water is only given every other day for a month, when it is supplied at intervals of three days, and this is continued for another month, by which time the plants have become nearly 2 feet high. They are now fit for transplanting. * * * The young plant on being taken out of the ground is reduced by nipping off about 6 inches from the centre shoot. After having been subjected to this treatment, the young plants are singly put into holes, previously dug for them, at distances of about a foot from each other. They are then watered daily until they have recovered the shock of transplanting, and afterwards, as they may require it. * * * The first year nothing is taken from the plants, but after that they yield, for years without intermission, a double crop. At each cutting, about 9 inches is taken from the top shoots of the plants. * * * The season for sowing is during April and May, that of transplanting, July and August. A year's produce of an acre of well-grown *mendhi* is 20 maunds of dry leaves, of which about 6 maunds are gathered in the spring, and

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* **References**:—Fl. Br. Ind., II., 573; Boiss., Fl. Or., II., 744; Watt, Dict. Econom. Prod., IV., 597; Atkinson, Econom. Prod. N.-W. Prov., III., 29; Edgeworth in Journ. As. Soc. Bengal, VIII., 755; Brandis, For. Fl., 238; DC., L'Orig. Pl. Cult. 109; *L. inermis*, Roxb., Fl. Ind. (Clarke's Ed.), 325; Royle, Ill. Him. Bot., 213; Stewart, Punj. Pl., 90; Pharmacogr. Ind. II., 41.

the rest during the autumn months, and the same plants continue to yield for 20 or 25 years. The selling price of the leaves averages a rupee for 12 seers, so that the value of the crop per acre is about Rs. 66. After the first year the expenses of cultivation do not much exceed those of other crops. The produce of the *mendhi* grown in this district is nearly all carried across the Jhelum and sold in the Northern districts, none of it finds its way to the south.

"The dye obtained from its leaves is chiefly used by native women, who dye their finger nails "a dull orange colour with it. It is also used for dyeing the hair. Used in combination with a "decoction of myrtle leaves a purplish black colour is obtained. * * * A decoction of the "leaves is occasionally used in dyeing cloth; the only colour reported to be produced from it is a "shade of light reddish brown known as *málagiri*." (Buck, Dyes and Tans, North-Western Pro-"vinces, p. 29).

Dr. Dymock says that this plant is much esteemed by Mahomedans. The leaves are applied to the soles of the feet in small-pox, and are supposed to prevent the eyes being affected by the disease. They are also considered to promote the healthy growth of the hair and nails. An infusion of the flowers is said to cure headache, and a pillow stuffed with them is used as a soporific.

MORINDA TINCTORIA, *Roxb.**

FORMA EXSERTA.†

[*Vide* Plate LXXXIX].

Ach-root, or Dyer's Indian Mulberry; al (the dye), **achhi** (the plant) (Hind.); **alakta** (Sans.)

Natural order *Rubiaceæ*. A small tree. Leaves opposite, oval or broadly elliptic, acute at both ends, not shining. Peduncles solitary or two together, leaf—opposed or in the axil of a reduced leaf. Flowers white, closely compacted. Fruit of many fleshy drupes combined into an oval mass.

Morinda exserta is described by Roxburgh as a distinct species, which he says may be immediately known by its exsert stamens, half-concealed stigma, and broad pointed leaves. Sir Joseph Hooker, however, in the Flora of British India, remarks—

"Under Roxburgh's descriptions and the above citations (given under *forma exserta*) are "included various forms of *Morinda* with exserted anthers, of which some are referable to *citrifolia* "and others to the varieties of *tinctoria;* and as the character of the anthers is sexual, this form "must be abandoned even as a variety, as Thwaites has pointed out."

References:—Fl. Br. Ind., III., 156; Watt, Dict. Econom. Prod., V., 261 (under *M. citrifolia*, Linn.), *M. exserta;* Roxb., Fl. Ind. (Clarke's Ed.), 183; Brandis, For. Fl., 276; Econom. Prod. N.-W. Prov., III., 15 (under *M. citrifolia*); Wright, Mem. Agri. Cawnpore, 57; Pharmacogr. Ind., II., 226.

† I am indebted to my friend Dr. David Prain of the Royal Botanical Garden, Calcutta, for the correct name of the plant represented in Plate LXXXIX., which was drawn from a Bundelkhand specimen.

M. tinctoria is by some botanists supposed to be the wild state of *M. citrifolia*, but as a species it may be distinguished by its smaller non-shining leaves. It appears probable that both species are employed in the extraction of the characteristic dye.

The cultivation of *ál* is almost entirely confined to the Bundelkhand districts of Hamirpur, Jhánsi, Jalaun, and Banda; and to limited areas of the Fatehpur and Cawnpore districts. The average area occupied by *ál* during the three years 1887-88 to 1889-90 was—Hamirpur 2,586 acres, Jhansi 2,191 acres, Jalaun 419 acres, and Banda 13 acres.

The following information regarding the cultivation of this plant and the preparation of the dye is taken from Wright's "Memorandum on Agriculture in the district of Cawnpore," and from the treatise on "Dyes and Tans" of the North-Western Provinces by Sir E. Buck and Mr. Fuller.

Cultivation and outturn.—*Al* is grown in black soil because it is friable. Land designed for *ál* is sown with the cold weather crops for two or three years, but is not manured. On the first fall of rain the land is ploughed, not less than five times, with the *bakhar* plough. This is a kind of hoe plough used in the Bundelkhand districts, and is a powerful instrument for breaking up the earth and eradicating weeds.

Towards the end of July the seed is sown broadcast and thoroughly mixed in the ground with the *bakhar*. Early rain after sowing is necessary, after which the plant sprouts in some 20 days. It is weeded four times, and has to be protected from cattle to prevent the young plants being trampled down. During the second rainy season it is about 2 feet high and is weeded twice. During the third and fourth years' rains the field is ploughed to allow the rain to reach the roots of the plant.

About the end of December the trees are cut down, and the roots are dug up with pickaxes; this will take ten men a month, as the ground has to be dug carefully and to the depth of 2 feet. Four men will chop it up into lengths whilst eight men are sorting them into different classes according to their thickness, *viz.*, thin, medium, and thick. The thin thread-like roots are the most valued; they are called *hárgharka*, or *bhára* (in Jalaun) and *bár* (in Jhánsi). The second quality, or medium-sized, are known as *lari;* and the third kind called *pachhkat* (*ghatiya* in Jalaun, and *lari* in Jhánsi) is composed of thick pieces. Very thick roots are called *katcráo;* they are almost worthless, but are peeled and mixed with *hárgharka* by way of adulteration. The roots are dried and packed in gunny bags. The seed is collected in the third year. The kernel is separated from the shell by the seed being kept watered till the shell rots, when the kernel is stamped out with the feet or a hoe. An acre will produce about 10 maunds of roots, one-third being of each class; 6 maunds of seed are also obtained.

Method of dyeing.—The colouring matter, as with safflower, is not extracted from the plant till in the actual operation of dyeing. The roots are mixed with a little sweet-oil and ground to powder in a hand mill. The cloth is dyed by being boiled with this powder. The kind of cloth most frequently dyed with *ál* is the coarse fabric known as *kharua*. The cloth is first of all washed and soaked in water with which some powdered sheep's dung has been mixed. It is then bleached; and for this pur-

pose a mixture is made of 4 lbs. of castor oil, 5 lbs. of the alkaline earth known as *rassi*, and 1¼ lbs. of sheep's dung in about 30 gallons of water. The cloth is steeped in this mixture for twelve days, and afterwards washed in clear water. It is then soaked in a decoction of myrobalan (*Terminalia Chebula*) in water, and after that in alum water. It is then ready for the application of the dye. For each piece of cloth, measuring 8 yards × 1 yard, 30 lbs. of powdered *ál* are mixed with water and boiled. Into the mixture, while boiling, the cloth is thrown and boiled with it till it has become dyed to the shade required. It is then cleaned and washed, and afterwards sized by being dipped in a solution of gum and water and beaten smooth with wooden clubs. The term *kháru* is properly applied to this cloth when it has been dyed a dull-red colour in this manner; before dyeing it is generally known as *ikri*. The manufacture and dyeing of this cloth is almost peculiar to the neighbourhood of Mau Ránipur, in the Jhánsi district. The following is the cost of dyeing a bale of 60 pieces of the cloth :—

	Rs.	A.	P.
20 lbs. of sheep or goat's dung, ...	0	0	3
4 gallons of castor oil, ...	3	8	0
3 „ of rassi, ...	0	8	0
6 lbs. of myrobalan, ...	0	4	0
3 „ of alum, ...	0	7	0
6 „ of dhá flower, ...	0	3	0
98 „ of ál (best quality), ...	12	0	0
86 „ of ál (inferior quality), ...	6	0	0
4 „ of soap, ...	1	0	0
20 „ of gum, ...	1	0	0
Washing, ...	1	0	0
Firewood, ...	1	0	0
Pay of beaters, ...	1	0	0
Total, ...	27	14	3

A bale of undyed *ikri* sells for Rs. 56; after dyeing it fetches Rs. 90, giving thus to the dyer a profit of Rs. 6-1-9. The well-known red *sálu*, much used for turbans, curtains, &c., is also dyed red with *ál*. The colour of the cloth remains permanent if the cloth is boiled in the tincture of *ál*.

Mr. Crooke, in his Glossary, states that from some mistaken connection with the Arabic "*ál*," meaning "family," natives think it unlucky to dig up the roots as it destroys one's *ál aulad*.

Explanation of Plate LXXXIX.

1. Root. | 2. Section of flower.
3. Cluster of fruits.

ABROMA AUGUSTA, *Linn.**

Perennial Indian Hemp. Ulat kambal (Hind.).

Natural order *Sterculiaceæ*. A shrub with cordate serrulate leaves, and large purplish flowers; found wild or cultivated, along the base of the Himalaya from the North-West Provinces to Sikkim.

In these Provinces, Dehra Dún is the only locality where the cultivation of this plant has been specially mentioned. The bark yields a strong white fibre which, in the opinion of Dr. Watt, might be used with advantage as a substitute for silk. Roxburgh says—

"As the plant grows so quickly as to yield two, three, or even four crops of cuttings annually, "fit for peeling, it may be advantageously cultivated for its fibres, which though not so strong as "hemp make good common cordage."

* **References**:—Fl. Br. Ind., I., 375; Roxb., Fl. Ind. (Clarke's Ed.), 510; Royle, Ill. Him. Bot., 102; Fibrous Pl. of India, 267; Watt, Dict. Econom. Prod., I, 7; Gamble, Man. Timbers, 45; Atkinson, Him. Dist., I., 792.

FODDER PLANTS.

THE fodder resources of these Provinces may be conveniently classed as follows:—

I.—The produce of cultivated crops, either specially grown to be used as fodder, or derivable as a secondary product in the form of straw, chopped straw *(bhúsa)*, oil-cake, &c.

II.—Indigenous grasses and other kinds of herbage, also the leaves and twigs of shrubs and trees.

With the exception of lucerne *(Medicago sativa)* and *Masúr-chana (Vicia hirsuta)*, the cultivated crops enumerated below have already been noticed in the three portions of this work.

For information concerning the various kinds of fodder obtainable from indigenous vegetation, the reader is referred to the author's article "Food and Fodder for Cattle" contributed to Dr. Watt's Dictionary of the Economic Products of India, Vol. III., p. 407; also to his book on the Indigenous Fodder Grasses of Northern India.

List of the cultivated crops of the North-Western Provinces and Oudh yielding food or fodder for cattle.

AVENA SATIVA *(Oats)*.—Affords excellent fodder for horses both green and as hay. It is not grown to any large extent in these Provinces except in the Meerut and Rohilkhand Divisions. (*See* also Part I., p. 13).

BRASSICA CAMPESTRIS.—All the oil-yielding varieties (*sarson*, *toriya*, &c.,) contribute more or less to the stock of cattle food in these Provinces. The thinnings from the fields, as well as the refuse after the oil has been extracted, are usually given to cattle. In many parts of the Punjab *sarson* is sown mainly as a fodder crop, and treated much in the same way as turnips. The autumn flowering variety, called *toriya*, is often plucked as green food for cattle. (*See* also Part II., pp. 28-32).

BRASSICA CAMPESTRIS, sub-species Rapa (*Turnip*).—(*See* Part III., p. 7).

BRASSICA JUNCEA *(Rai)*.—Occasionally given green to cattle when other kinds of fodder are scarce. (*See* also Part II., p. 33).

CAJANUS INDICUS *(Arhar)*.—The leaves furnish an excellent fodder. The husks and broken grain, after soaking in water, are sometimes given to cattle to keep them quiet when they are being milked.

CARTHAMUS TINCTORIUS *(Safflower)*.—The oil-cake resulting from the refuse of the seed after the oil has been extracted is much appreciated by cattle, though apt to taint the milk. The chaff is said to be sold in the Bulandshahr district as fodder for cattle. (*See* also Part I., p. 52).

CROTALARIA JUNCEA (*False hemp*, or *sanai*).—The tops are cut off and given to cattle when the plants are in full flower. The seed is also used as cattle food in some parts of India. (*See* also Part I., p. 82).

CICER ARIETINUM (*Gram* or *chana*).—The *bhúsa* or straw is much used as fodder, though considered by some to be injurious to milch cattle. In these Provinces it is seldom given alone, but more usually as a flavouring adjunct to less palatable fodders. In Bengal it is said to be not liked by cattle owing to its bitter taste. After the grain has been thrashed or trodden out by cattle the pod shells are separated by winnowing and burnt, or they are used as manure. The custom of allowing cattle to graze on the young crop is prevalent in some parts of the Punjab; and if after this the crop gets rain, the plants, it is said, grow up all the stronger for having been grazed over. (*See* also Part II., p. 24).

CYAMOPSIS PSORALIOIDES (*Guár*).—A variety of this plant is grown as a field crop for its grain which is given to cattle. For this purpose it is largely grown along with *bájra* in the Meerut and other Western districts of these Provinces. (*See* also Part II., p. 24).

DAUCUS CAROTA (*Carrot*).—*See* p. 9 of Part III.

DOLICHOS BIFLORUS (*Kulthi*).—*See* p. 2 of Part III.

ELEUSINE CORACANA (*Mandua* or *ragi*).—The straw is used as fodder. In the Punjab the crop is sometimes cut green; and, if the rainfall is sufficient, two or sometimes three cuttings are obtainable. In Mysore *rági* straw is considered to be the best fodder for cattle, which are said to be able to work and thrive on it alone without requiring grass. (*See* also Part II., p. 10).

ERUCA SATIVA (*Duan*).—If cattle fodder runs short in February *duan* is not unfrequently cut green and given to cattle in that state. It is largely used as green fodder in the Punjab, and is sometimes especially cultivated for this purpose. The oil-cake is also given to cattle. (*See* also Part II., p. 26).

GLYCINE HISPIDA (*Bhat*).—*See* p. 3 of Part III., under *G. Soja*.

GOSSYPIUM NEGLECTUM (*Cotton*).—The seed constitutes a valuable food for milch cattle. The oil-cake is also largely given. Cattle are sometimes allowed to graze on the leaves and shoots after the cotton has been picked. (*See* also Part I., p. 75, under *G. herbaceum*).

HORDEUM VULGARE (*Barley*).—Largely used as green fodder for cattle and horses. The *bhúsa* or broken up straw is highly valued as fodder, though inferior to that of wheat. The grain is given to horses either alone or mixed with gram, also occasionally to cattle when other kinds of grain are scarce. (*See* also Part I., p. 9).

LATHYRUS SATIVUS (*Kasári*).—The leaves and stalks are given to cattle. In the Punjab this plant is grown chiefly as green fodder for cattle. In Bengal cattle are allowed to graze on the plants which come up after the rice has been reaped. (*See* also Part II., p. 15).

LENS ESCULENTA (*Lentil* or *Masúr*).—The dry stalks and leaves are sometimes given

to cattle, though considered by some to be a heating form of food. (*See* also Part II., p. 13 under *Ervum Lens*).

MEDICAGO SATIVA* (*Lucerne*).—Natural order *Leguminosæ*. This plant appears to be truly wild in South-East Europe, Persia, Afghanistan, Baluchistan, and Kashmir. It is largely grown for green fodder in these Provinces, especially in the Meerut Division. The average area occupied by this crop in the district of Meerut for the three years ending 1889-90 is given as 545 acres. In the farm attached to the Remount Depôt at Saháranpur lucerne has for many years been cultivated to a large extent, as also at the Babugarh horse-breeding depôt near Meerut. Lucerne is a very profitable crop when grown under favourable conditions. It thrives best in a calcareous soil. Its strong tap root enables it to stand drought well, and very fair crops may be obtained without any artificial irrigation. If frequent cuttings and heavy crops are required, a liberal application of manure and constant waterings in dry weather are necessary. In this country the seed is sown either broadcast in beds, or on ridges. The latter is the preferable method, as weeding can be much more easily performed; and in localities where the rainfall is heavy the ridge system prevents the plants from being continually swamped during wet weather. In a note recently issued by the Department of Land Records and Agriculture, Bombay, Mr. Mollison, the Superintendent of Farms, gives some very useful information on lucerne cultivation as practised at the Babugarh Depôt, and at the Poona Experimental Farm. In both places the ridge system has been adopted, not only because it enables the crop to be more easily kept clear of weeds, and better drained, but the plants can be maintained in good health for a much longer period than in the case of broadcast sowings. Another advantage is that the quantity of seed per acre required for ridge sowings is smaller, about ten pounds of seed per acre being sufficient; whereas 16 to 20 lbs. is the usual quantity when sown broadcast.

ORYZA SATIVA (*Rice*).—The straw (*pial*) is not considered of much account for fodder purposes in these Provinces, and is used only when other kinds of fodder are not available. In Bengal and Southern India, however, rice straw constitutes the chief fodder, and in the Madras Presidency it is stacked in every district, and is said to remain good for upwards of three years. (*See* also Part I., p. 16).

PANICUM JUMENTORUM (*Guinea grass*) is a tall perennial grass from tropical Africa. It is grown locally in these Provinces, and chiefly in Government farms, and in gardens managed by Europeans. It is easily cultivated in the plains, and when irrigated is capable of yielding seven or eight cuttings during the year, a single cutting producing 180 maunds of green fodder suitable for all kinds of stock. It can be raised either by seed or by root-cuttings; the latter method is preferable. The ground should first of all be trenched and liberally manured, and at the commencement of the rainy season the cuttings may be dibbled in at about two feet apart on parallel ridges. As the plants become established less irrigation will be required, and the luxuriant growth of the crop will soon help to reduce the cost and labour of weeding. It is the habit of this grass to

* **References**:—Fl. Br. Ind., II., 90; Watt, Dict. Econom. Prod.; DC. L'Orig. Pl. Cult., 81.

form tussocks, which after a couple of years or so should be chopped asunder with a spade. Under proper cultivation guinea grass has been found to be a profitable crop. It is not liable to be attacked by fungus or insects, and thrives well under the shade of trees.

PANICUM MILIACEUM (*Chena*).—Yields excellent green fodder, but the straw is only fit to be used as bedding, or as a contribution to the manure heap. (*See* also Part II., p. 1).

PANICUM MILIARE (*Kutki*).—Cattle are said to be fond of the straw, as also that of *P. psilopodium* (*Mijhri*). (*See* also Part II., p. 7).

PASPALUM SCROBICULATUM (*Kodon*).—The straw is sometimes given to cattle. (*See* also Part II., p. 8).

PENNISETUM TYPHOIDEUM (*Bájra*).—The dry stalks are used as fodder, but they are greatly inferior to those of *juár*. (*See* also Part I., p. 30).

PHASEOLUS ACONITIFOLIUS (*Moth*).—The grain is often given to cattle, and is said to be very fattening. The stems and leaves, green or dry, are highly valued as fodder. (*See* also Part I., p. 41).

PHASEOLUS MUNGO (*Múng*).—The crushed stalks and leaves are much prized as fodder, and are often used to give a tempting flavour to trash which even Indian cattle might otherwise reject. (*See* also Part I., p. 38).

PISUM SATIVUM (*Common pea*, or *gol mattar*), and *P. arvense* (field pea, or *desi mattar*) yield excellent green fodder for cattle; and in many parts of the Punjab they are grown exclusively for that purpose. (*See* also Part II., p. 17).

RICINUS COMMUNIS (*Castor*).—Young castor leaves are relished by cattle.

SACCHARUM OFFICINARUM (*Sugarcane*).—The green tops and the stalks when juicy are sometimes given to cattle. (*See* also Part I., p. 56).

SESAMUM INDICUM (*Til*).—The oil-cake is used as cattle food, and in the Western districts is much prized on this account.

SETARIA ITALICA (*Italian millet*, or *kangni*).—The straw is used as cattle fodder, but it is not very nutritious. (*See* also Part II., p. 5).

SORGHUM VULGARE (*Juár*).—The dry stalks and leaves chopped into small pieces constitute the ordinary cattle fodder in these Provinces for some months in the year, and is known by the name of *karbi*. Juár is often grown as a fodder crop only, in which case it is sown earlier and more thickly than when cultivated for its grain. It is almost the only green fodder crop cultivated as such in these Provinces, and hence when grown for this purpose has no more distinctive a name than *chari*, which simply means fodder. *Chari* cultivation, however, is almost entirely restricted to the districts of the Meerut Division, where the cattle are mostly purchased from outside districts, and are of a far better quality than those in other parts of the Provinces. Its value as a green fodder may be inferred from the following analysis made by Professor Voelcker, in which its nutritive qualities are compared with those of turnips:—

	Chari.	Turnips.
Water, ...	85·17	90·43
Flesh-forming matters, ...	2·55	1·04
Fatty and heat-producing matters, ...	11·14	7·89
Inorganic matters, ...	1·14	·64
	100·00	100·00

(*See* also Part I., p. 28).

TRIGONELLA FŒNUM-GRÆCUM (*Methi*).—*See* Part III., p. 46.

TRITICUM SATIVUM (*Wheat*) is often cut green and given as fodder to cattle. The chopped straw or *bhúsa* is a very important cattle food in these Provinces. It is usually given mixed with the chaff of gram and other pulse crops to render it more wholesome. (*See* also Part I., p. 1).

VICIA HIRSUTA (*Masúr-chana*).—Natural order *Leguminosæ*. Occasionally cultivated as a fodder crop during the cold weather months, and on the hills during the summer up to about 5,000 feet.

VIGNA CATIANG (*Lobiya*).—The leaves and stems are used as cattle fodder.

ZEA MAYS (*Indian corn*).—If the outturn of grain does not promise well the crop is cut while green and given to cattle; or the leaves and stalks are dried and mixed with other green fodder. The young esculent stalks contain much saccharine matter and are relished by cattle. (*See* also Part I., p. 21).

The following analyses of the Cereal grains and Pulse seeds yielded by crops mentioned in this work are taken from Professor Church's "Food Grains of India."

Name of crop.	Water.	Albuminoides.	Starch.	Oil.	Fibre.	Ash.	Remarks.
Paspalum scrobiculatum (husked), ... (Kodon).	11·7	7·0	77·2	2·1	0·7	1·3	
Panicum miliaceum (husked), ... (Chena).	12·0	12·6	69·4	3·6	1·0	1·4	
Panicum miliare, ... (Mijhri).	10·2	9·1	69·0	3·6	4·6	3·5	
Panicum frumentaceum (with husk), ... (Sáwan).	12·0	8·4	72·5	3·0	2·2	1·9	
Setaria italica (husked), ... (Kangni).	10·2	10·8	73·4	2·9	1·5	1·2	
Pennisetum typhoideum (with husk), .. (Bájra).	11·3	10·4	71·5	3·3	1·5	2·0	
Zea Mays, ... (Indian corn).	12·5	9·5	70·7	3·6	2·0	1·7	
Oryza sativa, ... (Rice).	12·8	7·3	78·3	·6	·4	·6	
Sorghum vulgare, ... (Juár).	12·5	9·3	72·3	2·0	2·2	1·7	
Sorghum saccharatum, ... (Imphi).	12·8	11·8	68·3	3·0	3·0	1·1	
Avena sativa, ... (Oats).	12·7	10·1	56·0	2·3	16·6	2·3	
Eleusine Coracana (husked), .. (Mandua).	13·2	7·3	73·2	1·5	2·5	2·3	
Eleusine Coracana (with husk), ... (Mandua).	12·5	5·9	74·6	0·8	3·6	2·6	
Triticum vulgare, ... (Wheat).	12·5	13·5	68·4	1·2	2·7	1·7	
Hordeum vulgare (husked), ... (Barley).	12·5	11·5	70·0	1·3 (Fat).	2·6	2·1	
Amarantus paniculatus (seeds), ... (Chua márs a).	12·5	14·3	60·4	6·8	3·4	2·6	
Amarantus gangeticus (seeds), ... (Chaulai).	12·1	14·5	61·8	6·3	2·6	2·6	
Fagopyrum esculentum (husked), (Common buckwheat).	13·4	15·2	63·6	3·4	2·1	2·3	Analysis of ordinary buckwheat obtained in Europe.
	13·3	14·2	66·6	2·0	1·9	2·0	Analysis of sample obtained from India in 1892.
Fagopyrum tataricum (husked), ... *Var.* himalaica. (Kangra buckwheat).	14·2	12·7	67·8	3·1	0·7	1·5	Analysis made by Professor Church in 1892.
Cyamopsis psoralioides, ... (Guár).	11·8	29·8	46·2	1·4	7·7	3·1	
Cicer arietinum (husked), ... (Gram).	11·5	21·7	59·0	4·2	1·0	2·6	
Cicer arietinum (with husk), ... (Gram).	11·2	19·5	53·8	4·6	7·8	3·1	
Lathyrus sativus, ... (Kasári).	10·1	31·9	53·9 (including fibre).	·9	...	3·2	
Pisum sativum (husked), ... (Pea).	11·8	28·2	55·0	1·5	1·0	2·5	
Pisum sativum (with husk), ... (Pea).	12·5	23·6	54·5	1·3	5·7	2·4	
Lens esculenta (husked), ... (Lentil).	11·8	25·1	58·4	1·3	1·2	2·2	
Lens esculenta (with husk), ... (Lentil).	11·7	24·9	56·0	1·5	3·6	2·3	

Name of crop.	Water.	Albuminoides.	Starch.	Oil.	Fibre.	Ash.	Remarks.
Glycine Soja, ... (Soy bean).	11·0	35·3	26·0 (including sugar)	18·9 (Fat).	4·2	4·6	
Canavalia ensiformis, ... (Bara sem).	12·5	25·0	48·6	2·8	7·7	3·4	
Phaseolus vulgaris, ... (Haricot bean).	14·0	23·0	52·3	2·3	5·5	2·9	
Phaseolus Mungo (with husk), ... (Múng).	10·8	22·2	54·1	2·7	5·8	4·4	
Phaseolus Mungo (green seed, with husk), ... (Múng).	11·4	23·8	54·8	2·0	4·2	3·8	
Phaseolus Mungo, *var.* radiatus (yellow seed, with husk), ... (Urd).	10·1	22·7	55·8	2·2	4·8	4·4	
Phaseolus aconitifolius, ... (Moth).	11·2	23·8	56·6	·6 (Fat)	4·2	3·6	
Vigna Catiang (husked), ... (Lobia).	12·5	24·1	56·8	1·3	1·8	3·5	
Vigna Catiang (with husk), ... (Lobia).	12 7	23·1	55·3	1·1	4·2	3·6	
Dolichos Lablab (with husk), ... (Sem). (1, C.)	14·6	17·1	57·4	2·3	5·0	3·6	
Dolichos Lablab (with husk), ... (Sem). (2, C).	14·3	20·5	53·5	2·2	5·8	3·7	
Dolichos Lablab (husked), ... (Sem). (3).	12·1	24·4	57·8	1·5	1·2	3·0	
Dolichos Lablab (with husk), ... (Sem). (4).	12·1	22·4	54·2	1·4	6·5	3·4	
Dolichos biflorus (with husk), ... (Khulti).	11·0	22·5	56·0	1·9	5·4	3·2	
Cajanus indicus (husked), ... (Arhar). (1, W).	10·5	22·3	60·9	2·1 (Fat).	1·2	3·0	
Cajanus indicus (with husk), ... (Arhar). (2, C).	13·3	17·1	55·7	2·6 (Fat).	7·5	3·8	
Cajanus indicus (with husk), ... (Arhar). (3, W).	11·4	20·3	56·4	1·4 (Fat).	7·1	3·4	

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Varagu, see Panicum miliaceum, ...	II.	1	
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Botanical, Vernacular, and English names.	Part.	Page.	Number of Plate.
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APPENDIX A.

On page 1 of the Introduction to Part I. a Table is given in which are shown the details of the area within each Revenue Division of the N.-W. Provinces and Oudh for the year 1880-81. In the Table given below these details are again shown by comparison with those for the year 1889-90.

		Meerut Division.	Agra Division.	Rohilkhand Division.	Allahabad Division.	Benares Division.	Jhansi Division.	Kumaun Division.	Total, N.-W. Provinces.	Total, Oudh.	Total, N.-W. Provinces and Oudh.
		Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Cultivated, ...	1880-81,	4,439,680	4,036,928	4,400,320	5,004,928	6,422,144	1,373,184	506,752	26,483,936	8,400,896	34,584,832
	1889-90,	4,409,942	3,642,313	4,386,618	4,717,280	6,138,021	1,244,168	213,229	24,751,571	8,873,699	33,625,270
Per cent. on total, ..	1880-81,	61·3	62·1	63·2	56·9	54·7	43·0	6·3	36·9	54·2	50·9
	1889-90,	60·9	56·1	62·8	53·6	61·8	39·7	40·1	57·4	57·3	57·4
Uncultivated but cultivable, ..	1880-81,	1,636,608	1,088,448	1,909,056	2,030,272	2,082,560	1,194,496	754,240	10,695,680	4,318,336	15,014,016
	1889-90,	1,901,621	1,534,162	1,941,571	2,290,591	2,406,256	1,317,863	275,810	11,667,874	4,406,679	16,074,553
Per cent. on total, ..	1880-81,	22·6	16·8	27·4	23·1	17·8	37·5	9·5	15·7	27·7	22·1
	1889-90,	26·2	23·7	27·9	26·0	24·2	42·0	52·0	27·1	28·4	27·4
Uncultivable, ...	1880-81,	1,168,448	1,371,200	655,680	1,761,984	3,230,976	621,824	6,699,200	15,509,312	2,798,336	18,307,648
	1889-90,	931,779	1,310,096	652,011	1,791,387	1,384,418	574,994	41,823	6,686,508	2,218,533	8,905,041
Per cent. on total, ..	1880-81,	16·1	21·1	9·4	20·0	27·5	19·5	84·2	22·8	18·1	27·0
	1889-90,	12·9	20·2	9·3	20·4	14·0	18·3	7·9	15·5	14·3	15·2
Total, ...	1880-81,	7,244,736	6,496,576	6,965,056	8,797,184	11,735,680	3,189,504	7,960,192	52,688,928	15,517,568	67,906,496
	1889-90,	7,243,342	6,486,571	6,980,200	8,799,258	9,928,695	3,137,025	530,862	43,105,953	15,498,911	58,604,864

The following Tables show the average percentages of the rabi, kharif, and total cropped area occupied by the more important crops during two periods of three years each, *viz.*, 1878-79 to 1880-81 and 1887-88 to 1889-90. (*See* Part I., p. xxi., of Introduction).

Crop.	*Percentage on*		*Percentage on*	
	Kharif area.	Total area.	Kharif area.	Total area.
Kharif.	1878-79 to 1880-81.		1887-88 to 1889-90.	
Juár,	10·7	5·7	2·5	1·3
Bájra,	7·7	4·1	3·5	1·8
Arhar,	1·0	0·5	1·5	0·8
Juár and arhar,	12·1	6·4	10·5	5·3
Bájra and arhar,	7·7	4·1	6·7	3·4
Maize,	5·7	3·0	8·5	4·3
Rice,	21·3	11·3	31·5	16·0
Urd,	2·0	1·0	..	..
Urd and mung,	..	..	4·3	2·2
Moth,	1·6	0·9	1·6	0·8
Mandua and kodon,	..	..	5·7	2·9
Cotton,	4·1	2·2	1·4	0·7
Cotton and arhar,	6·9	3·6	6·0	3·1
Sugarcane,	4·8	2·5	5·6	2·9
Sanai or til,	..	..	1·1	0·5
Indigo,	2·0	1·1	1·6	0·8
Fodder crops,	2·6	1·3	3·5	1·7
Garden food crops,	0·1	0·1	0·4	0·2
Garden non-food crops,	0·1	0·1	0·1	0·1
Miscellaneous food crops,	7·8	4·1	3·9	2·0
Miscellaneous non-food crops,	1·8	1·0	0·1	0·1

Crop.	*Percentage on*		*Percentage on*	
	Rabi and Zaid area.	Total area.	Rabi and Zaid area.	Total area.
Rabi.	1878-79 to 1880-81.		1887-88 to 1889-90.	
Wheat,	28·6	13·4	23·5	11·5
Wheat and gram,	8·1	3·8	8·1	4·0
Wheat and barley,	9·5	4·2	8·5	4·2
Barley,	13·5	6·3	10·6	5·1
Barley and gram,	19·2	9·5	15·9	7·8
Gram,	10·3	4·8	17·2	8·4
Peas,	3·3	1·5	6·7	3·3
Masur,	1·0	0·4	1·3	0·6
Potatoes,	0·1	0·1	0·2	0·1
Turnips, carrots, and radishes,	..	..	0·2	0·1
Opium,	1·3	0·6	1·3	0·6
Tobacco,	0·2	0·1	0·2	0·1
Alsi or sarson,	..	..	3·6	1·8
Melons,	0·2	0·1	0·4	0·2
Chena or sawan,	..	..	0·4	0·2
Vegetables,	0·1	0·0	0·1	0·1
Garden food crops,	0·1	0·0	0·1	0·1
Garden non-food crops,	0·2	0·1	0·1	0·1
Miscellaneous food crops,	1·3	0·6	0·8	0·4
Miscellaneous non-food crops,	3·0	1·5	0·8	0·4

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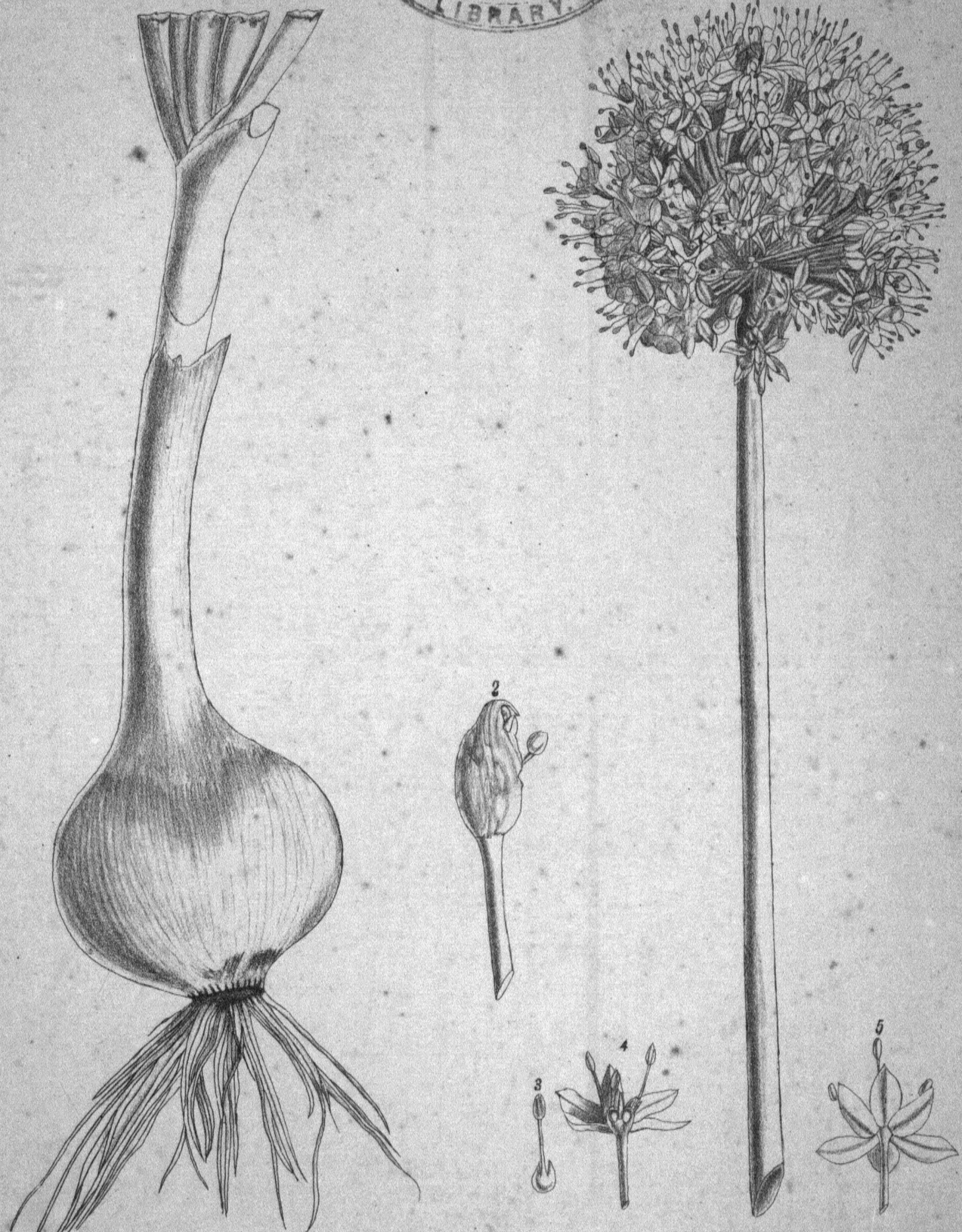

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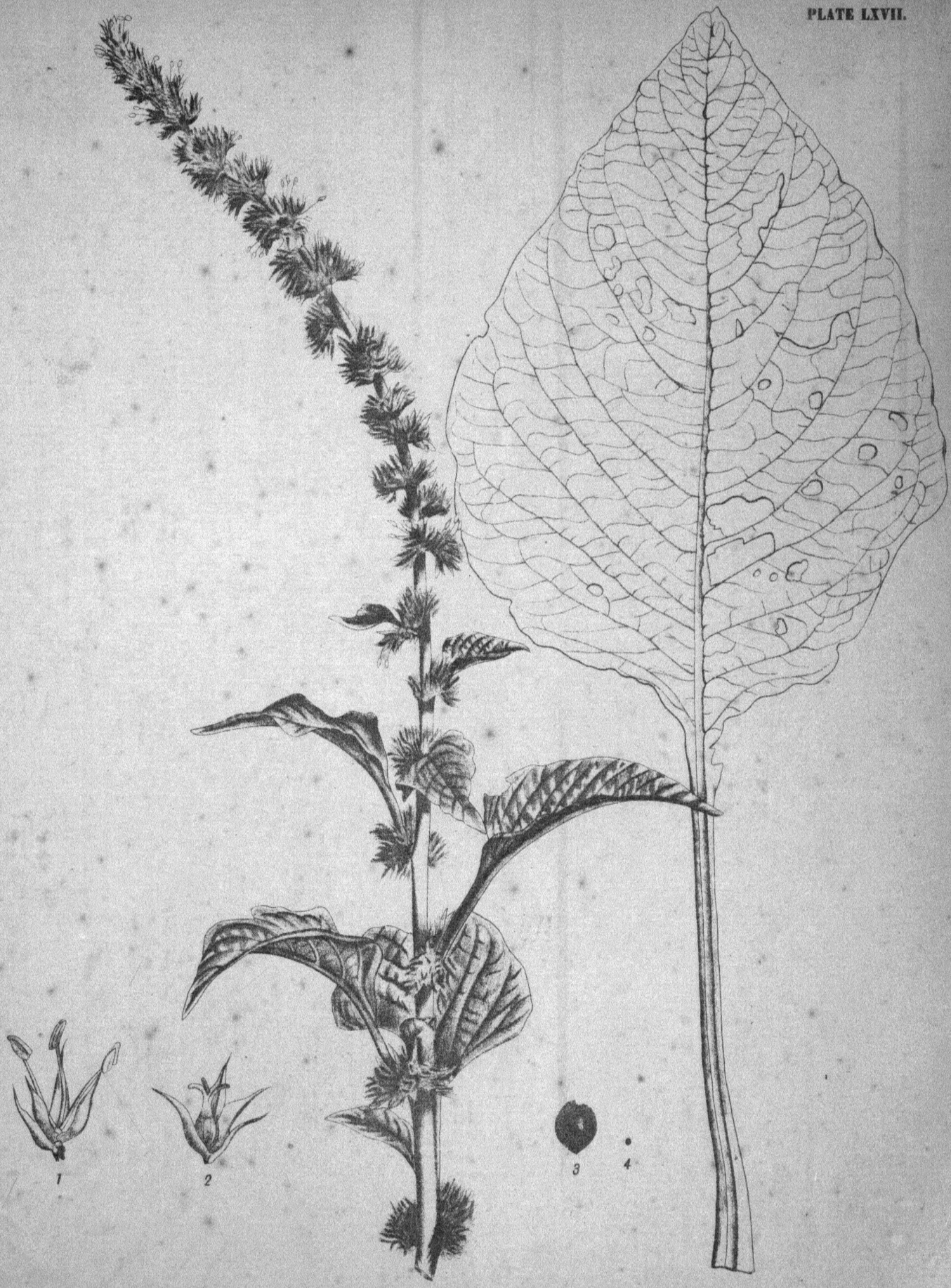
ALLIUM CEPA, WILLD.

Litho. T. C. Press, Bourkes.
Thos. D. Bona, *Supdt.*

ALLIUM SATIVUM, L.

Drawn by H. Hormuzji

Lithe. T. C. Press, Roorkee.
Thos. B. Bona, *Supdt.*



AMARANTUS GANGETICUS, LINN.

Drawn by M. Hormusji

Litho. T. C. Press, Bombay.

AMARANTUS PANICULATUS, LINN.

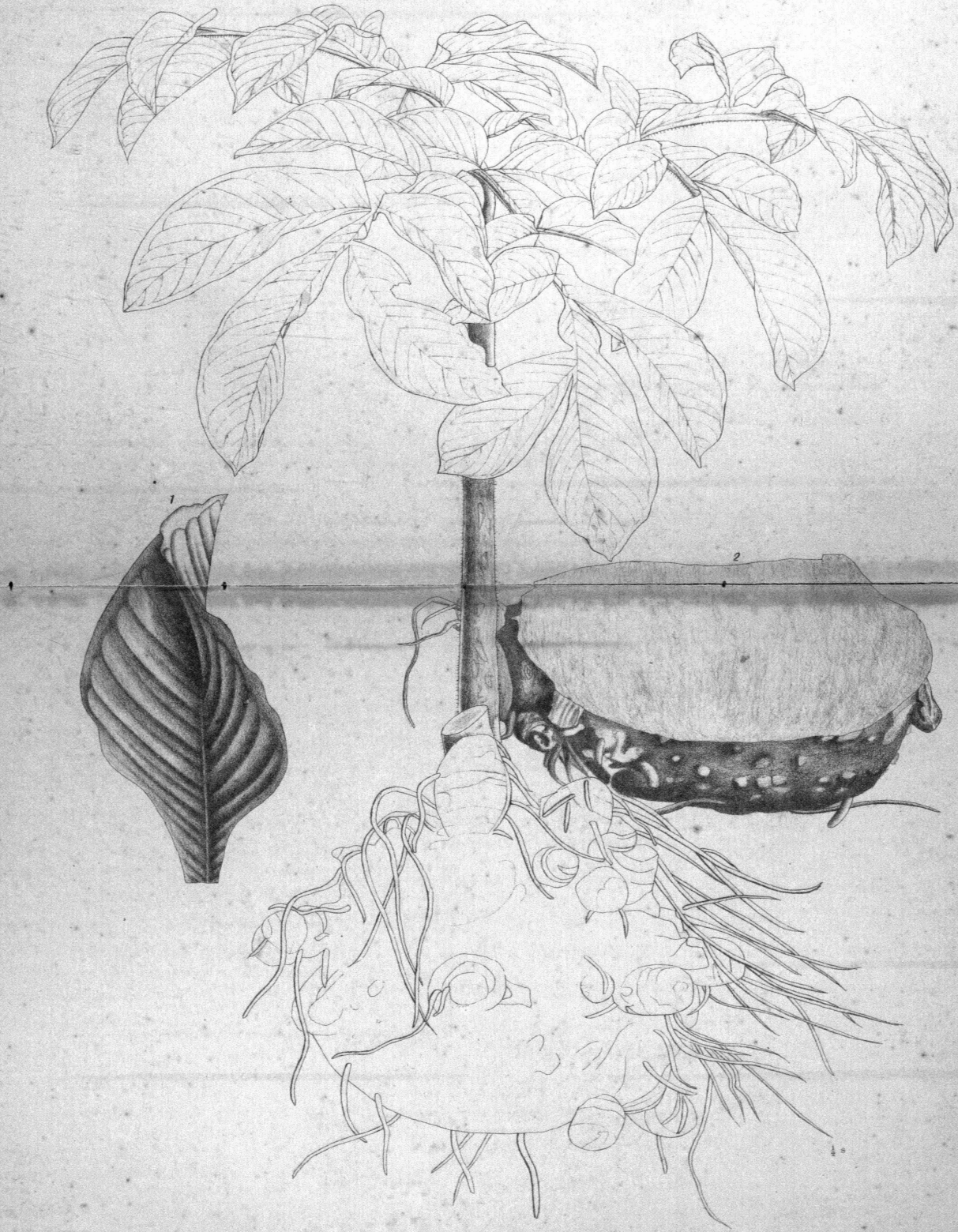
Drawn by H. Hormusji.

Litho. T. C. Press, Roorkee.

AMARANTUS CAUDATUS, LINN.

Drawn by R. Hermusji.

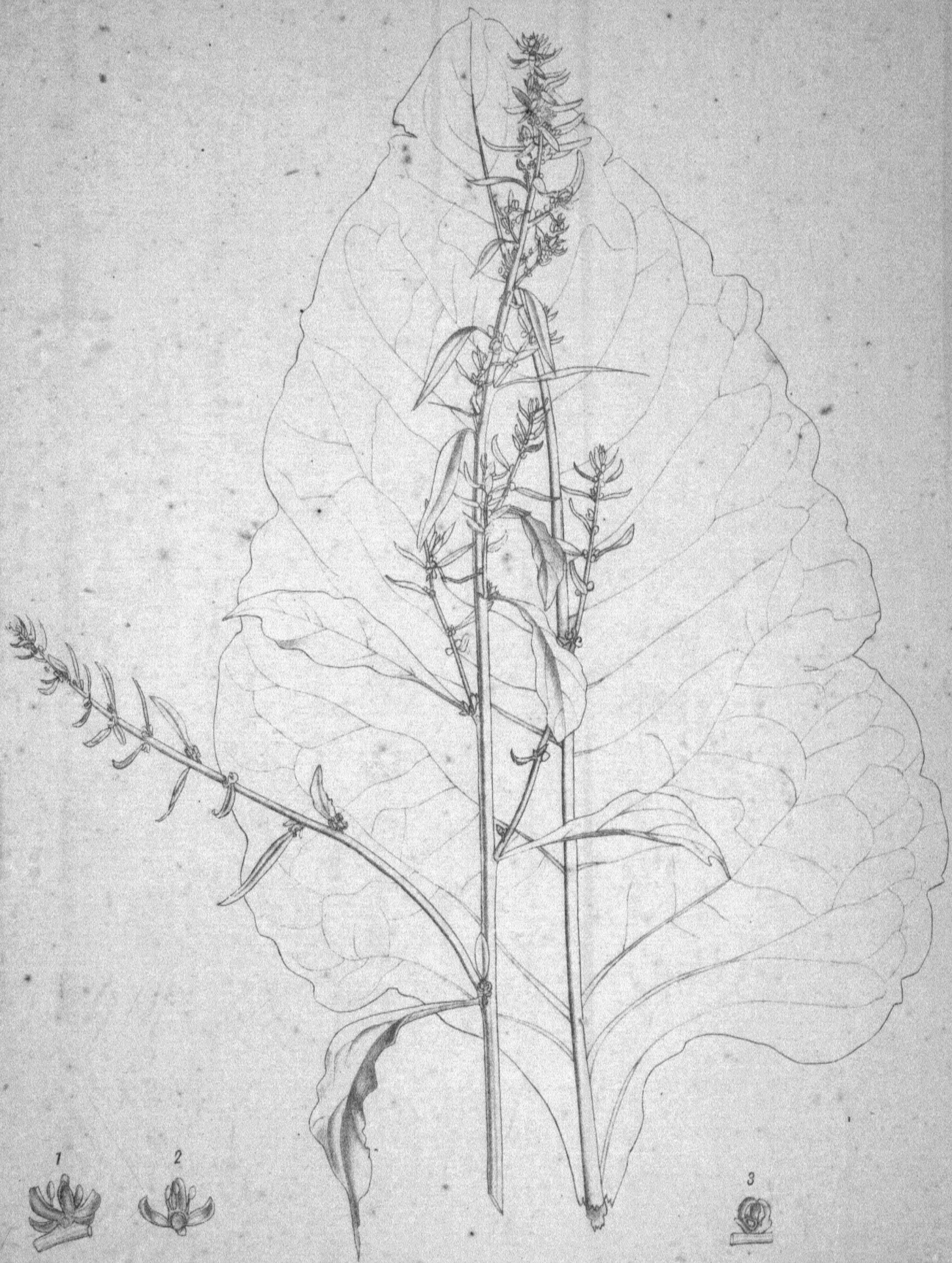
Litho. T. C. Press, Roorkee.—No. 386-72



Drawn by H. Hormusji.

~~ARUM CAMPANULATUM, Roxb.~~
AMORPHOPHALLUS CAMPANULATUS, Blume.

Litho. T. C. Press, Boorkee.
Thos. D. Bona, Sculpt.



BETA BENGALENSIS, Roxb.

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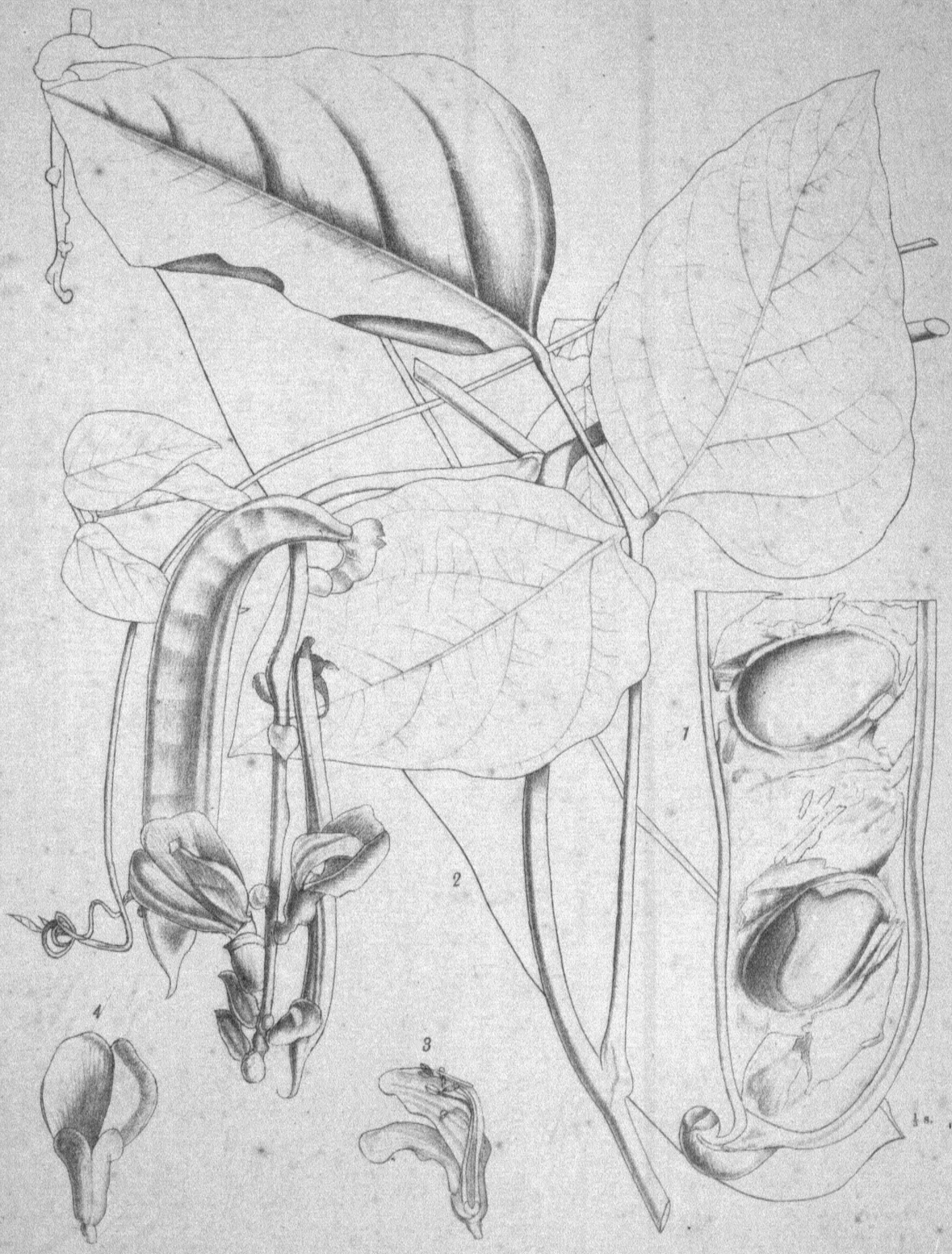

CANAVALIA ENSIFORMIS, DC.

Drawn by H. Hormusji.

Litho. T. C. Press, Poorkee.
Thos. D. Bona, *Supdt.*

CAPSICUM ~~FRUTESCENS, L.~~
MINIMUM, ROXB.

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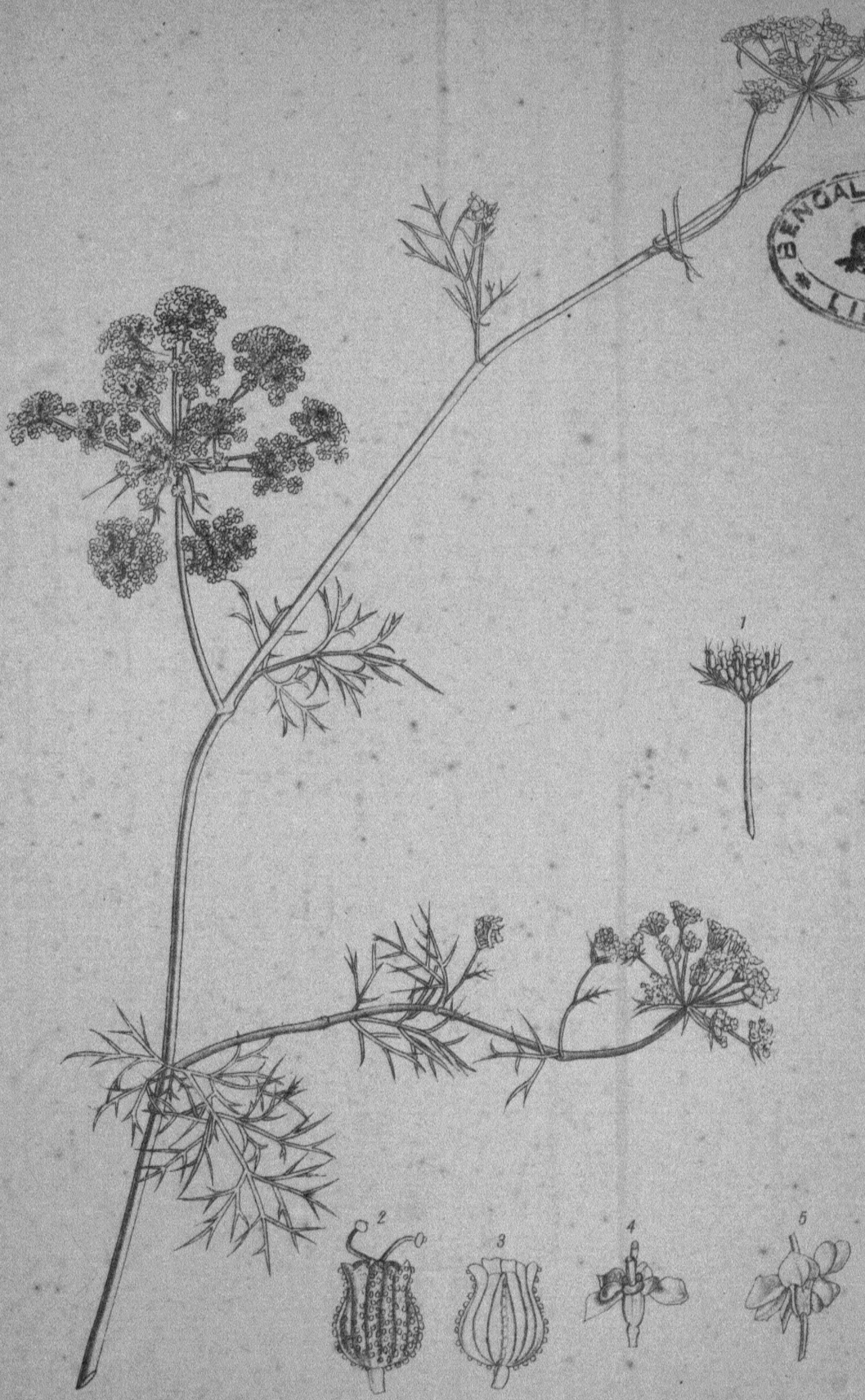
Litho T. C. Press, Roorkee.
Thos. D. Bons, Supdt.

PLATE LXXIII.
~~VI—6.~~



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CARUM COPTICUM, BENTH.

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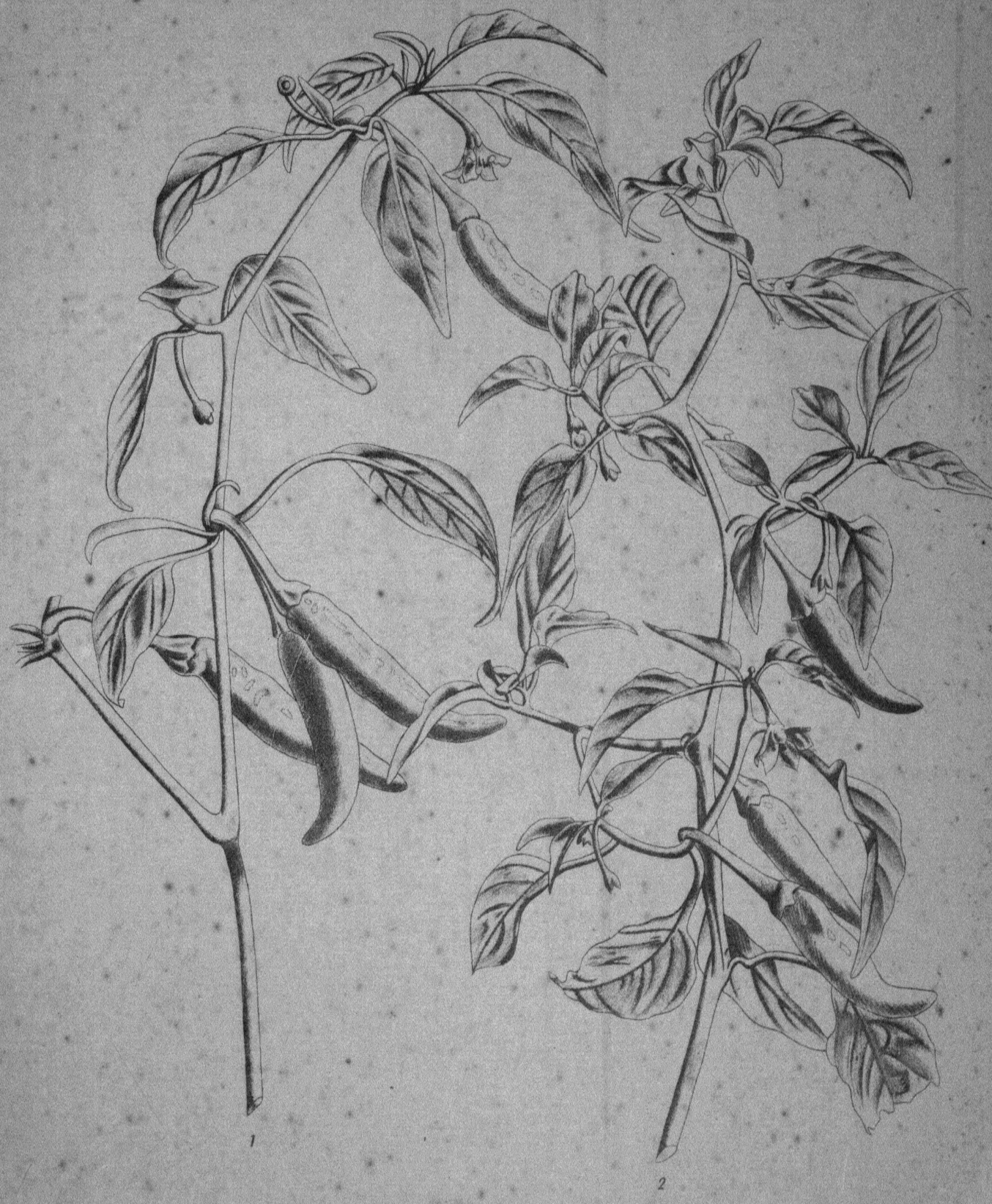


CAPSICUM FRUTESCENS, LINN.

Drawn by H. Mormusji

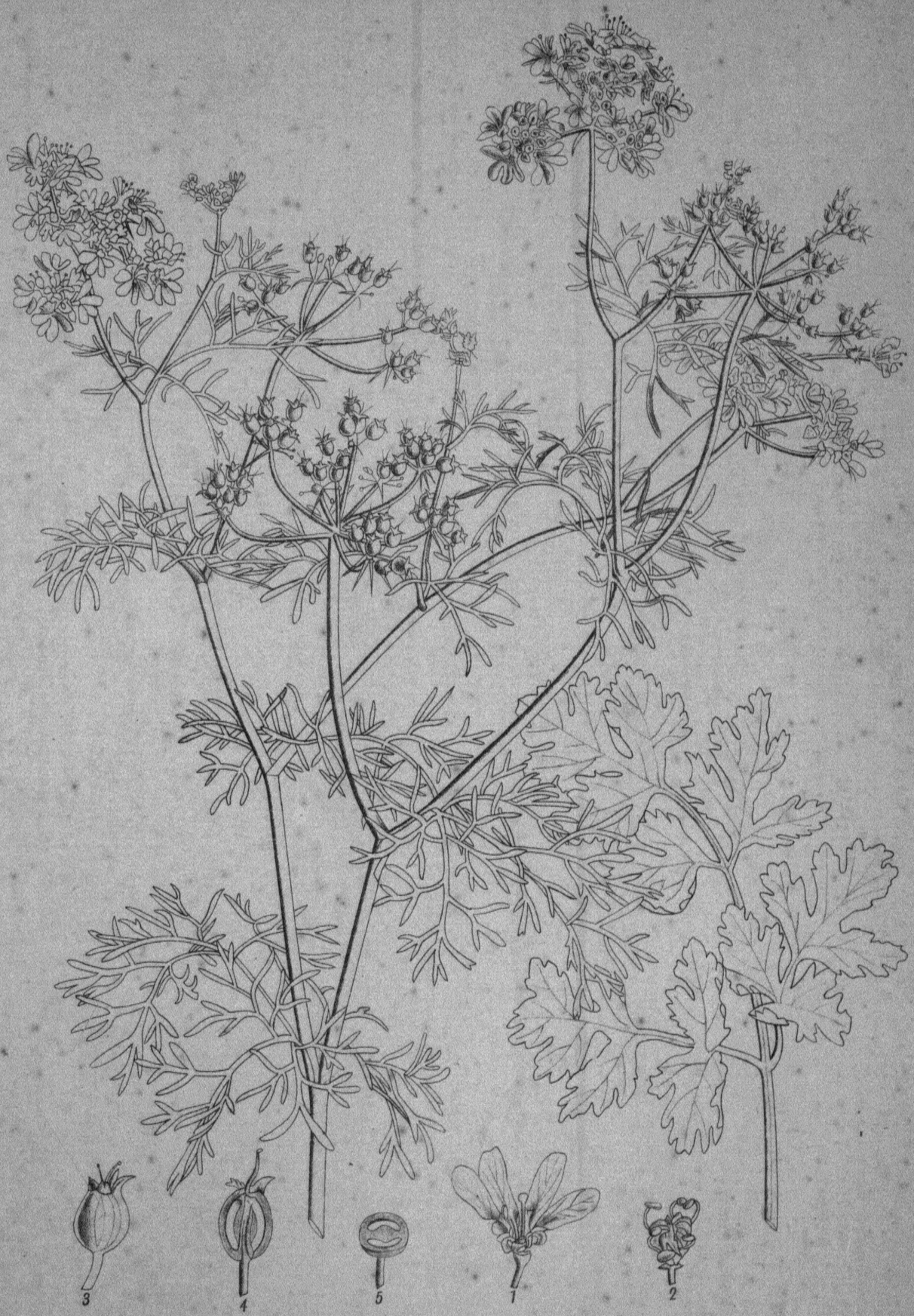
Litho. T. C. Press, Roorkee.

~~ARUM COLOCASIA, L.~~

COLOCASIA ANTIQUORUM, SCHOTT.

[Drawn by H. Hormus].

Litho. T. C. Press, Rookee.
Thos. P Bona, *Suprt.*



CORIANDRUM SATIVUM, LINN.

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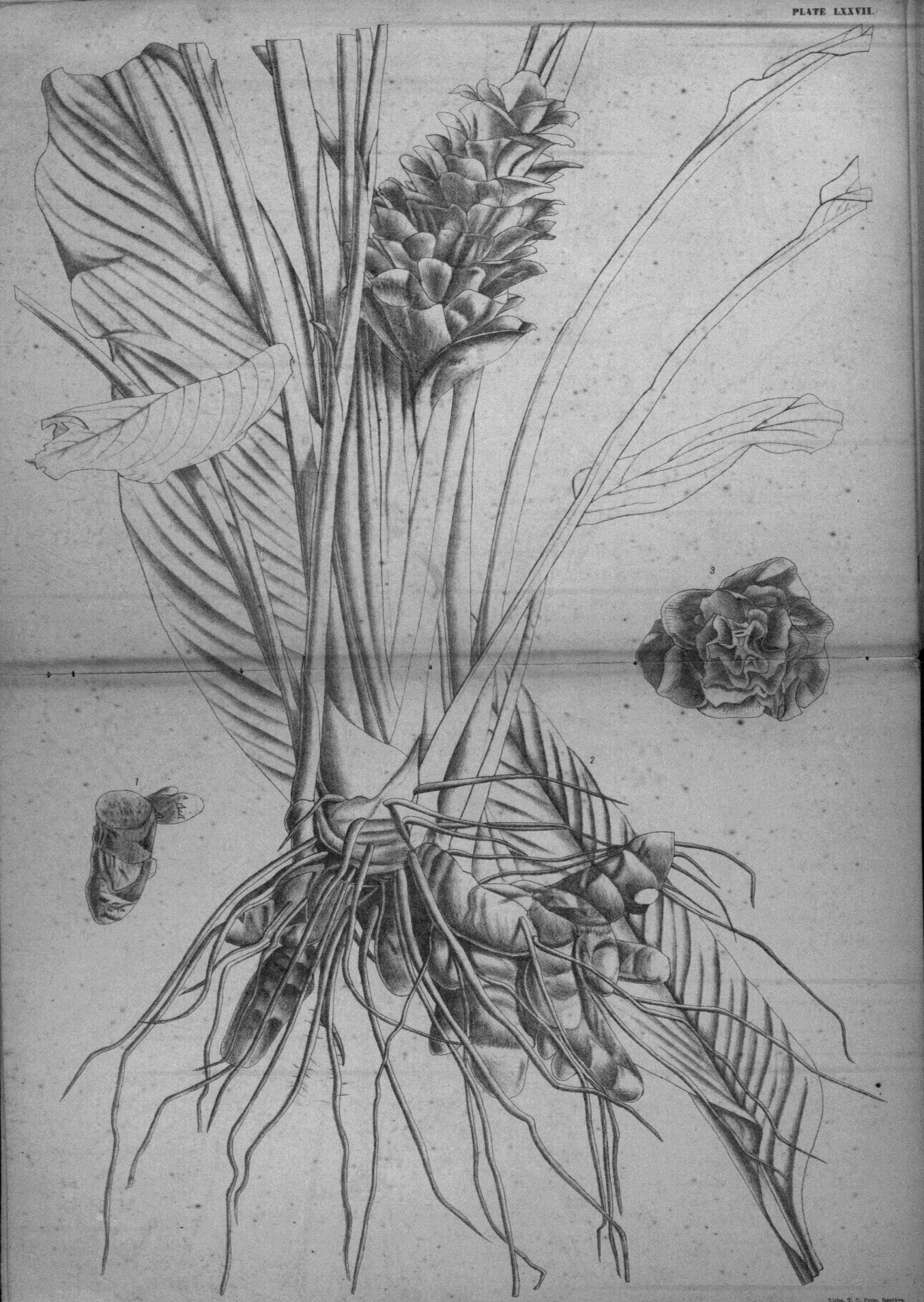

CURCUMA LONGA, L.

Drawn by H. Hormisch.

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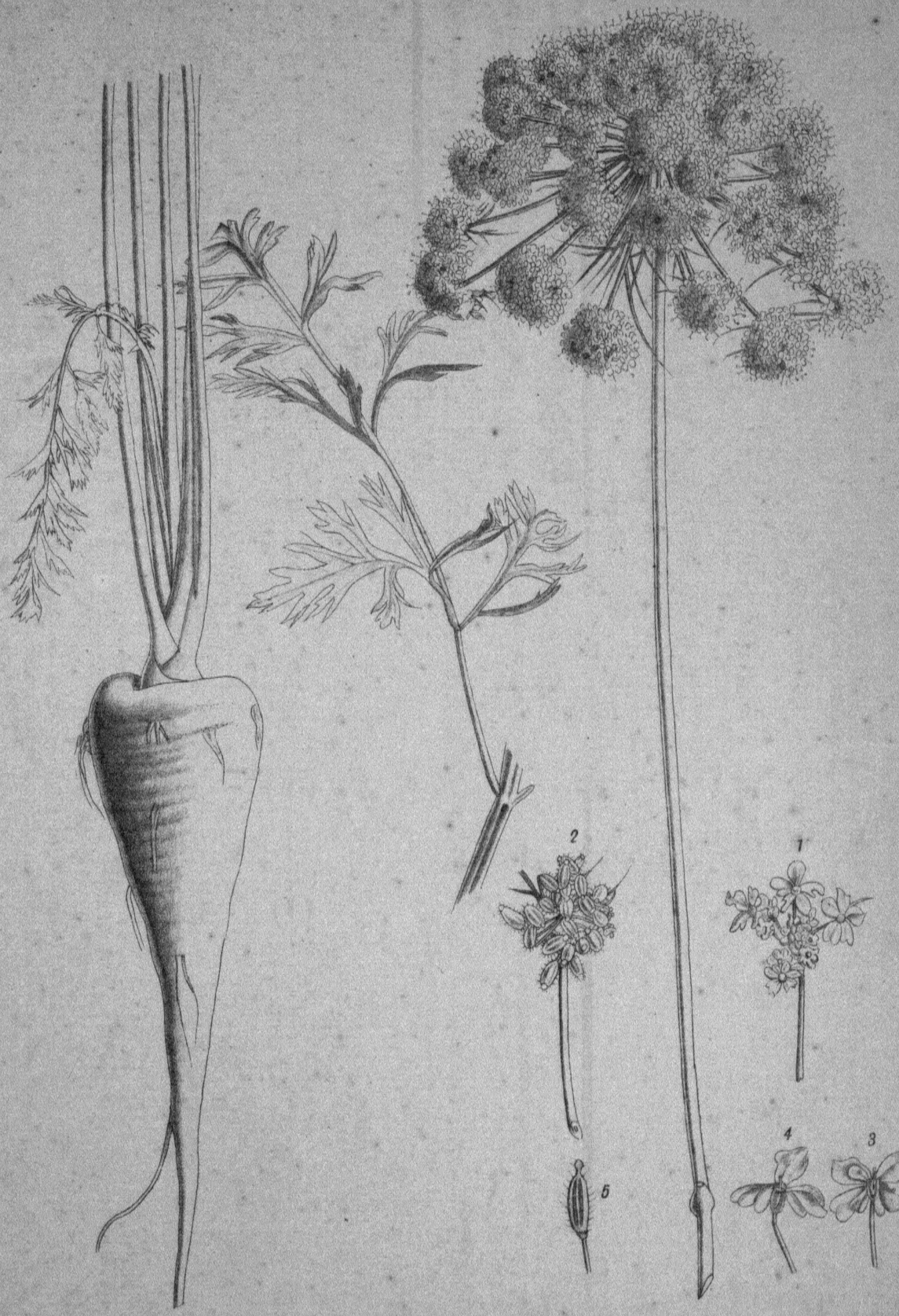

DAUCUS CAROTA, L.

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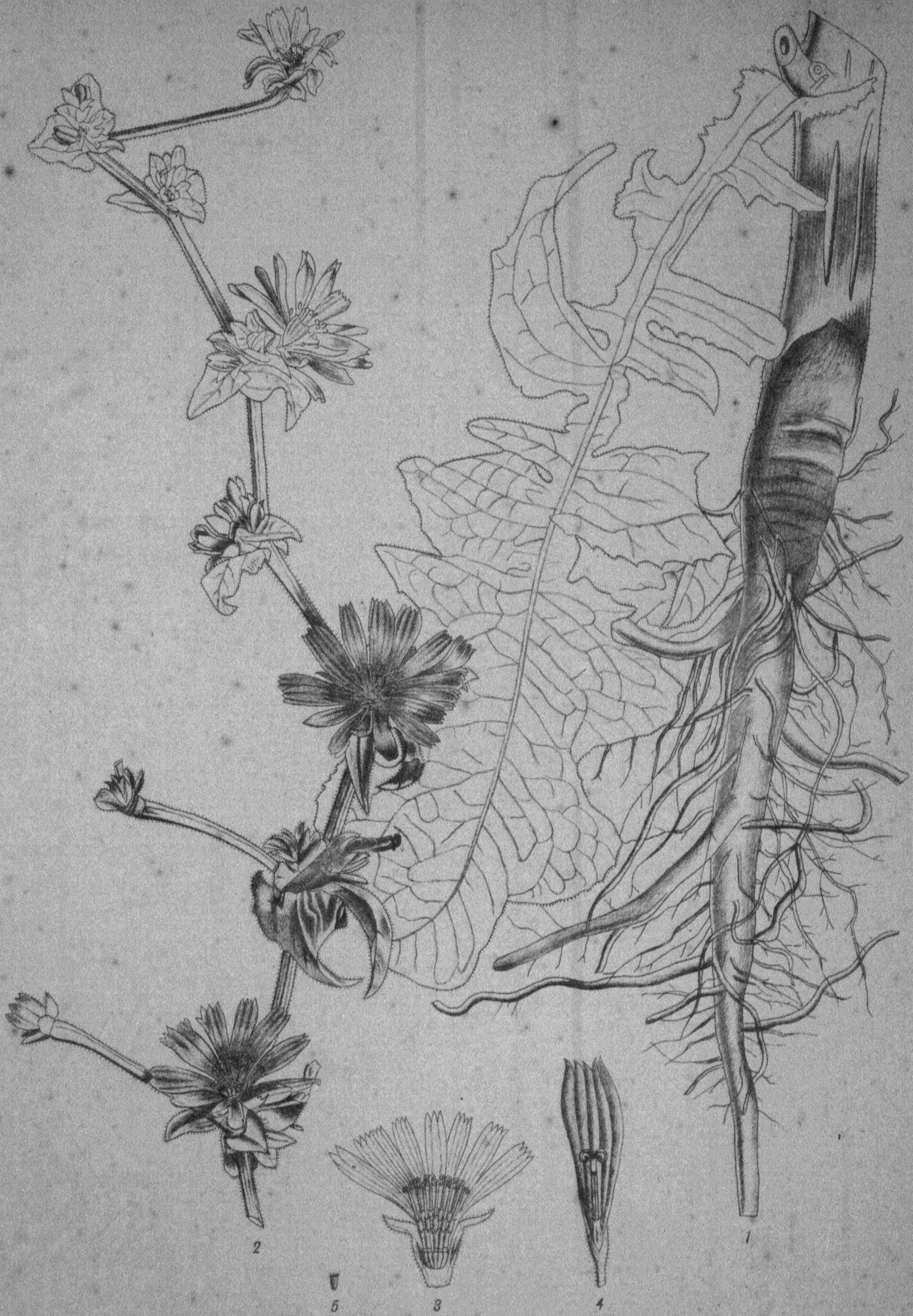

CICHORIUM INTYBUS, LINN.

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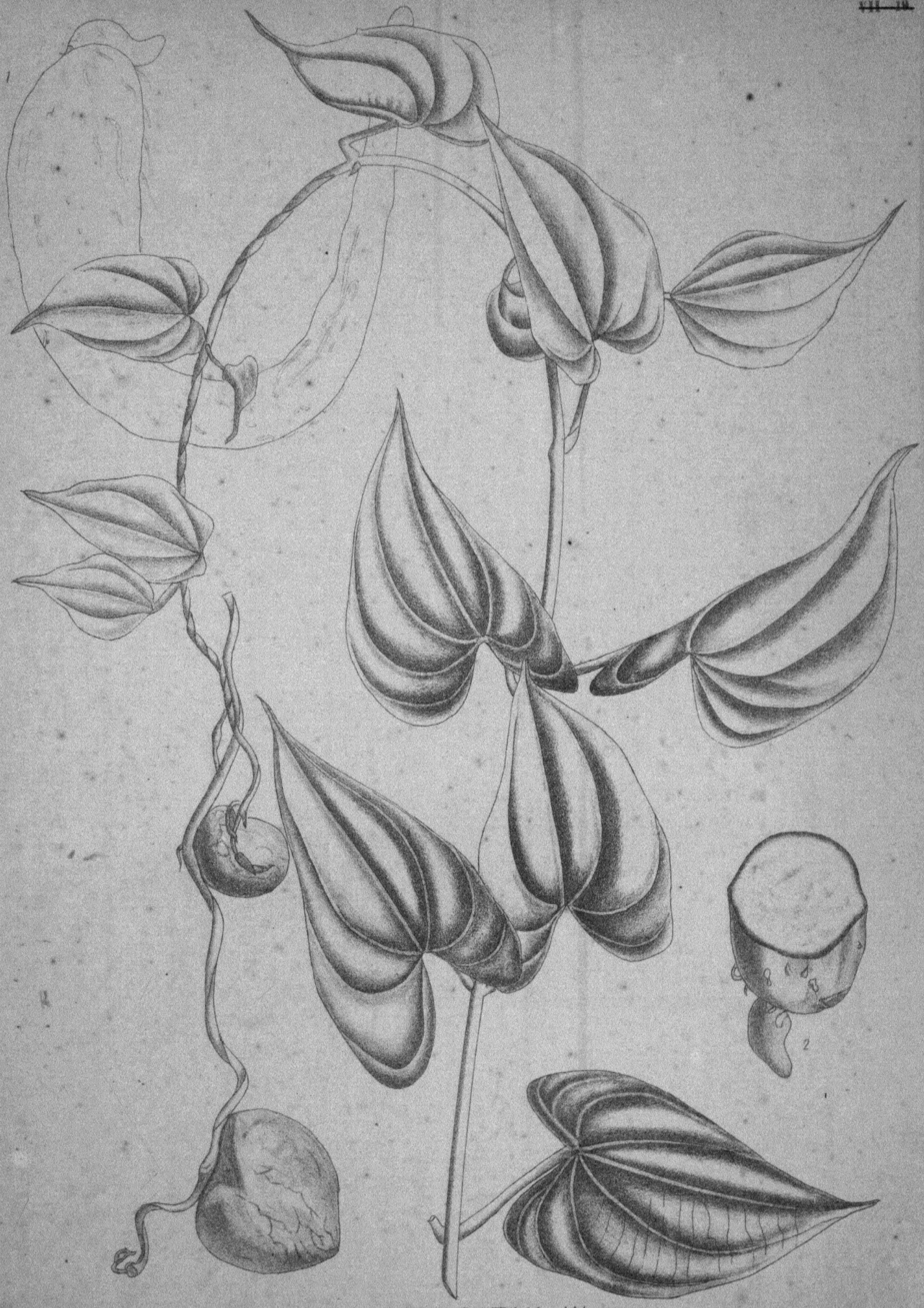
Litho. T. C. Press, Roorkee.



DIOSCOREA SATIVA, WILLD.

Drawn by H. Hormuzji

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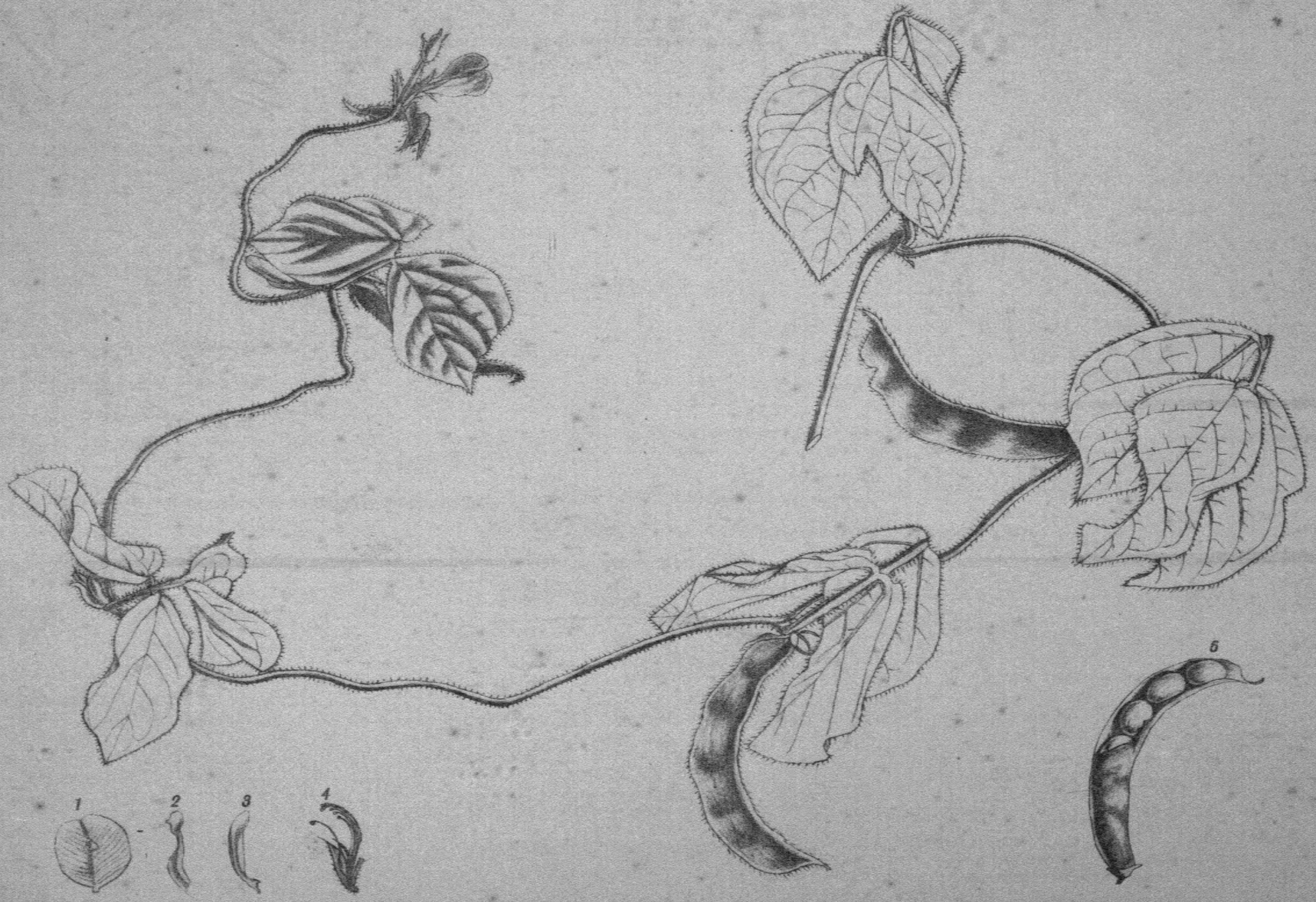

DOLICHOS BIFLORUS, LINN.

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FŒNICULUM VULGARE, GÆRTN.

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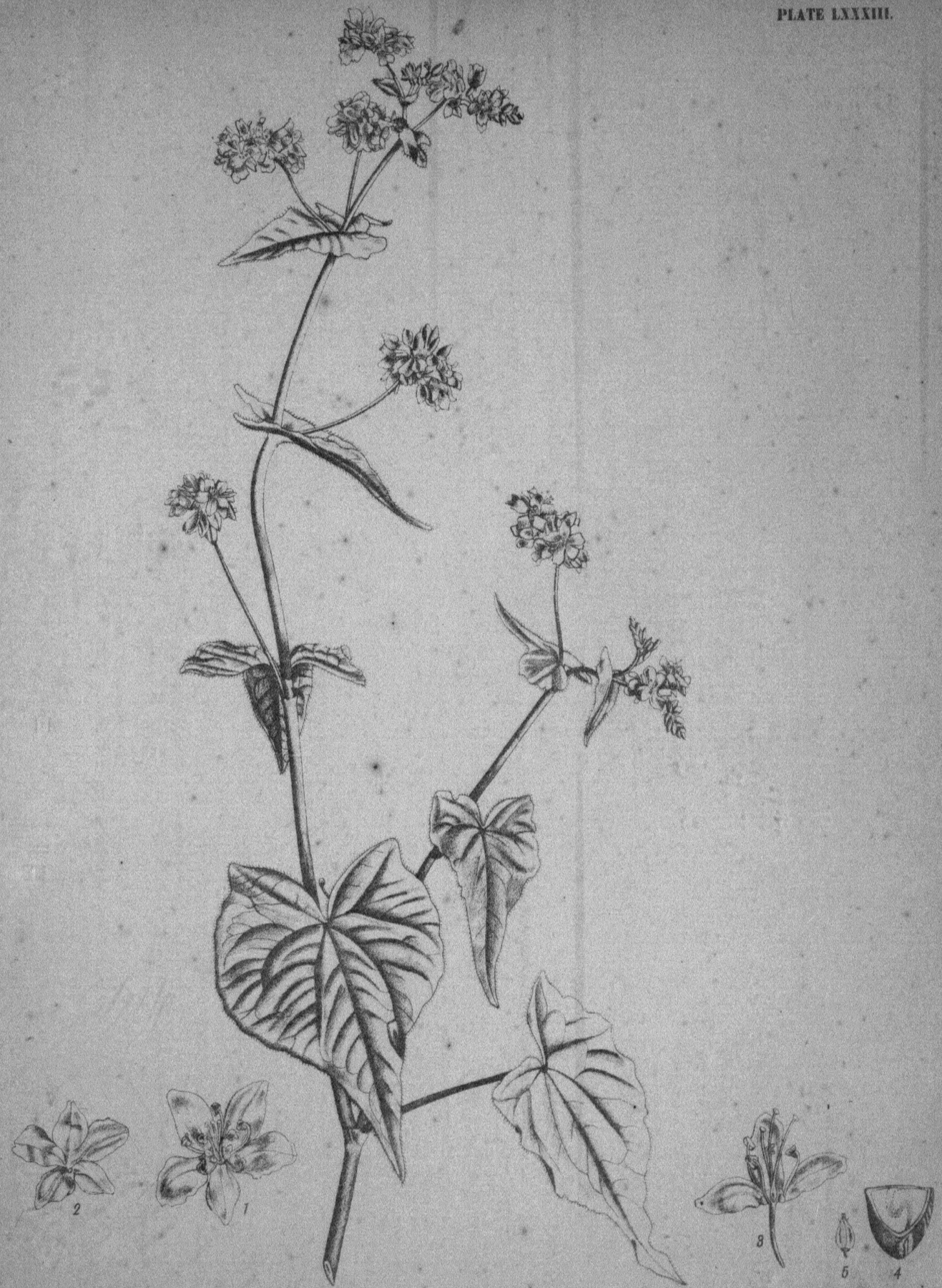

FAGOPYRUM ESCULENTUM, MŒNCH.

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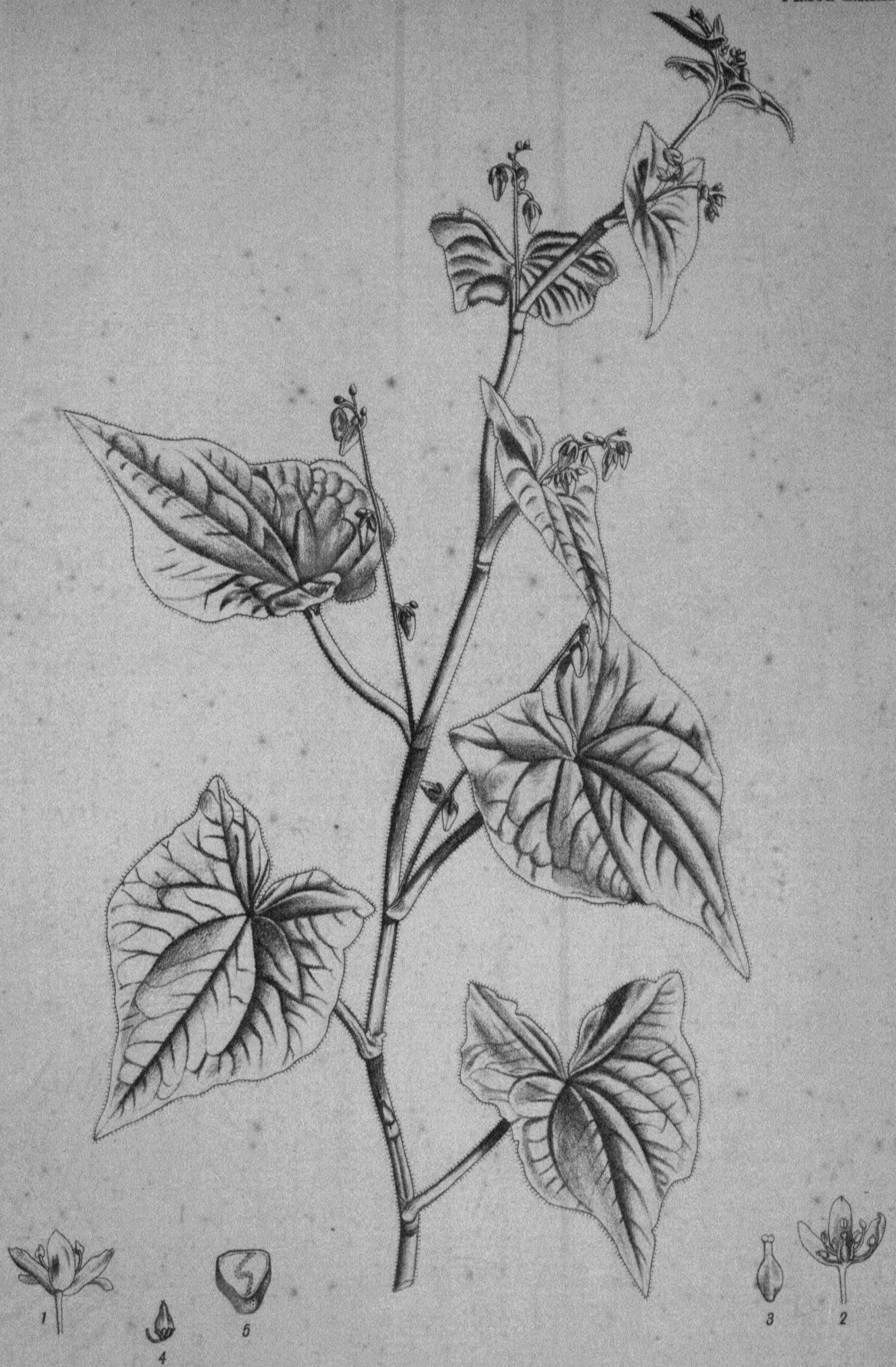
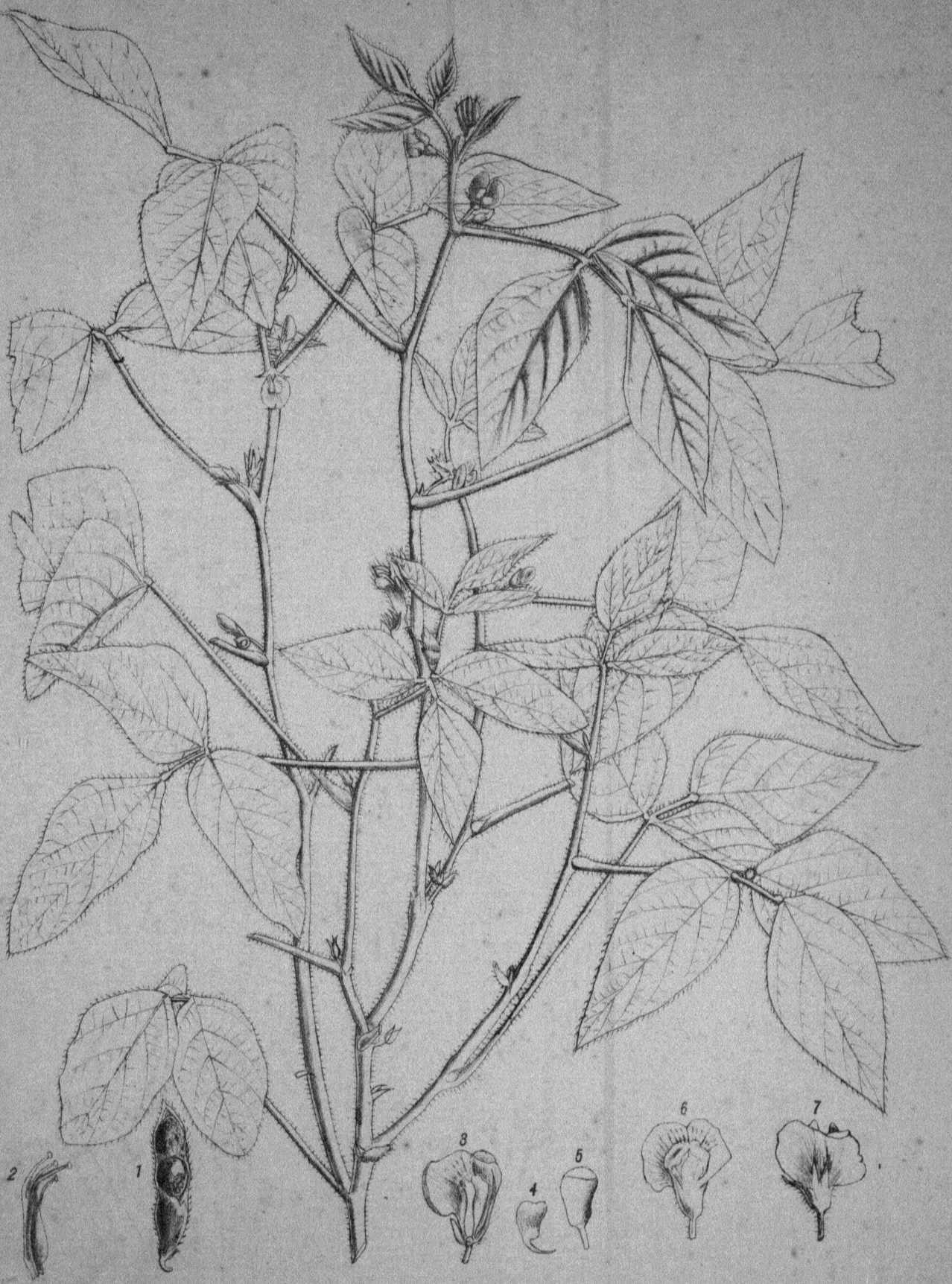


FAGOPYRUM TATARICUM, GÆRTN.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.



Drawn by H. Hormusji

GLYCINE ~~SOJA, SIEB. & ZUCC.~~
HISPIDA, MAXIM.

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PLATE LXXXVI.
~~VII—2.~~

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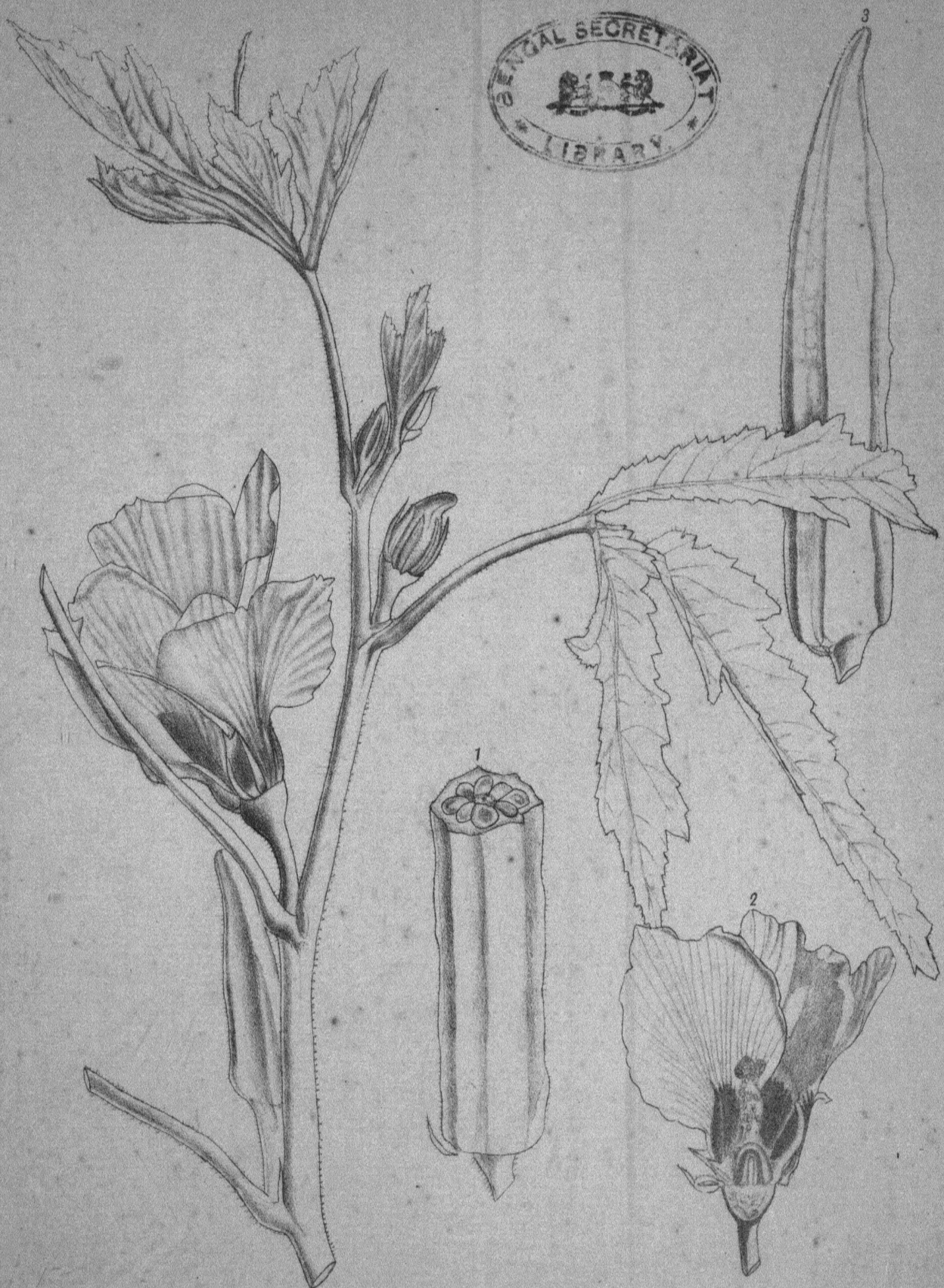

HIBISCUS ESCULENTUS, L.

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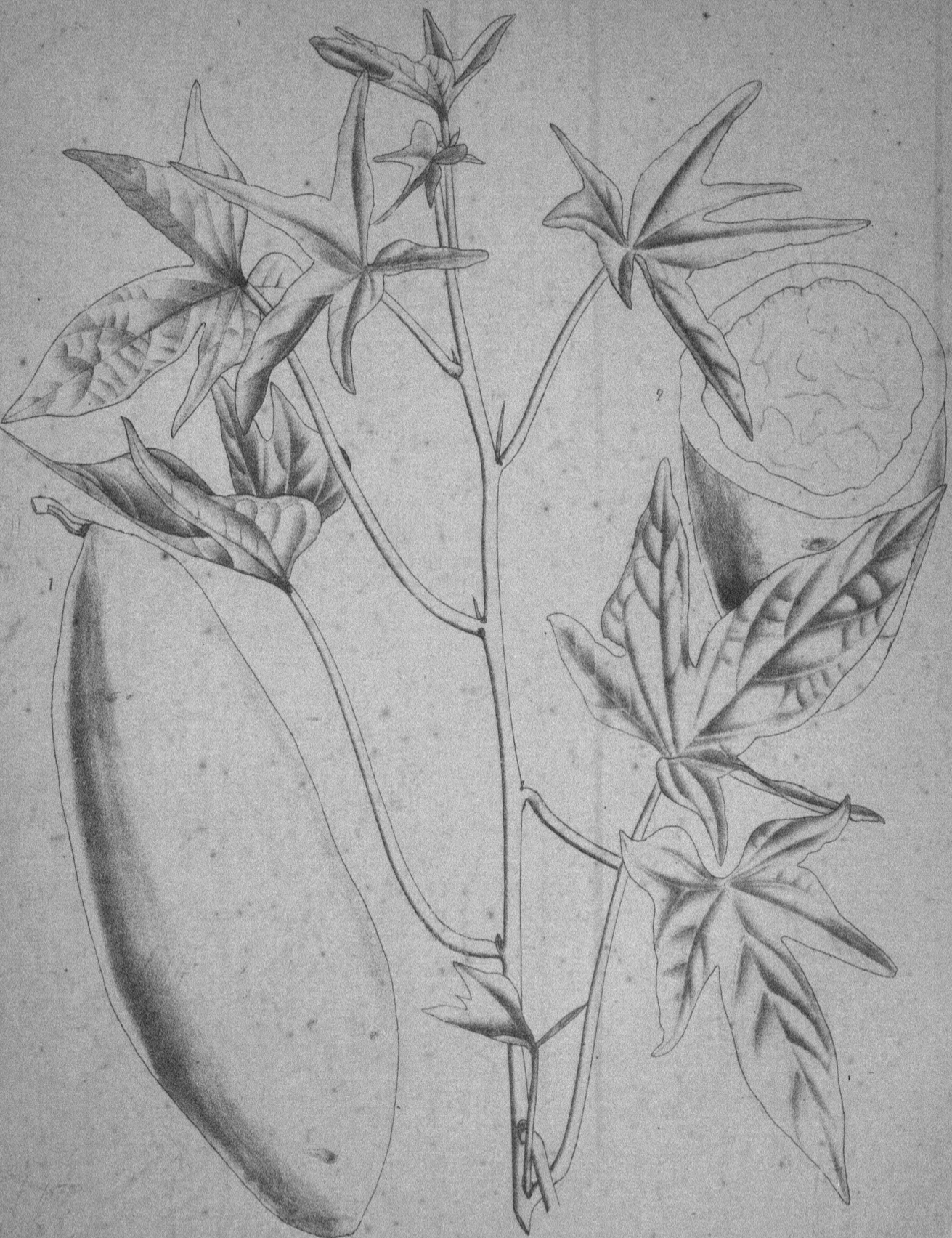
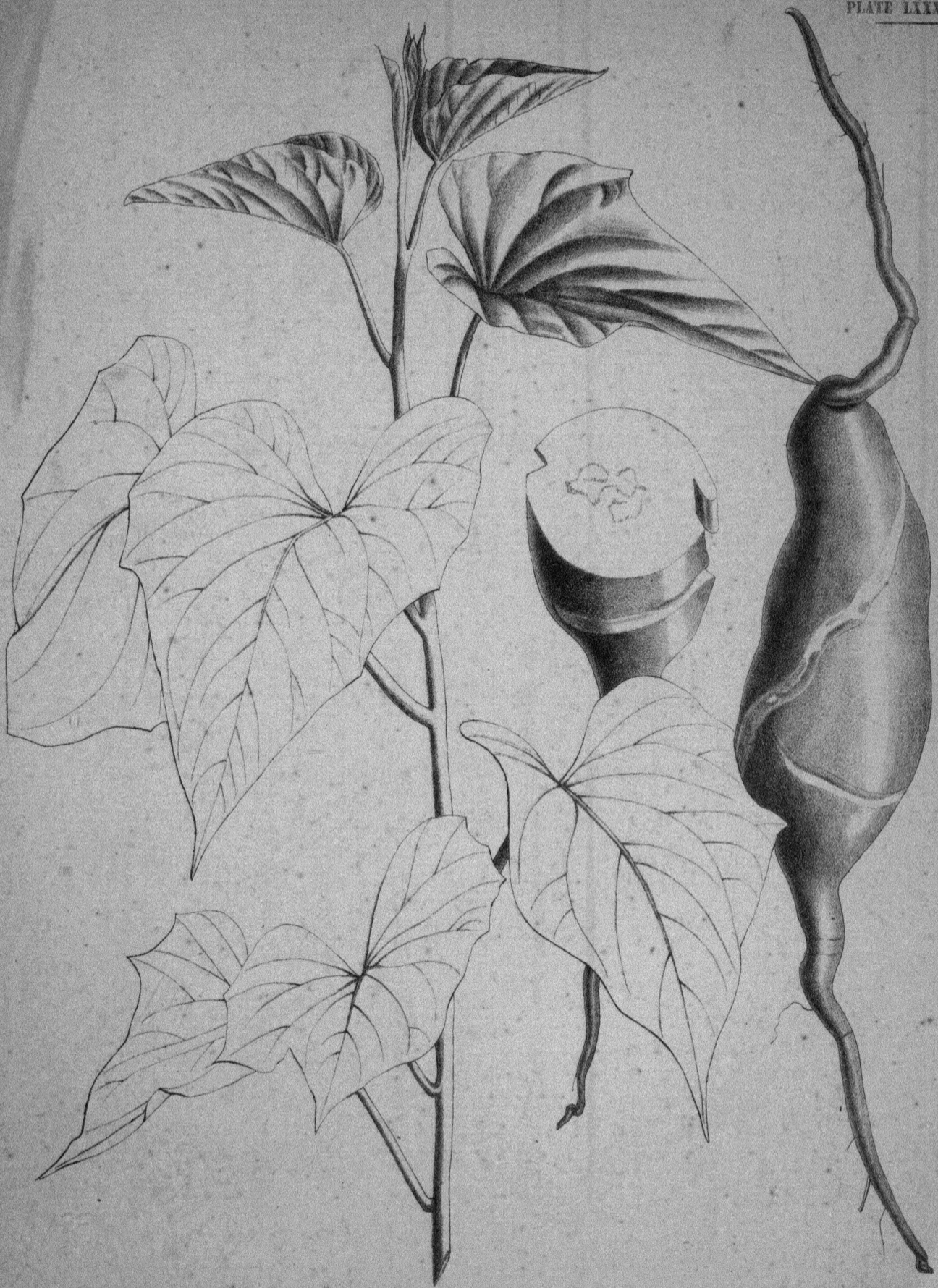
Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.



~~BATATAS EDULIS, CHOISY.~~
IPOMÆA BATATAS, LAMK.

Drawn by H. Hermuuji.

Litho. T. C. Press, Bourkes.
Thos. D. Bons, *Sapdt.*



~~BATATAS EDULIS, Choisy.~~
IPOMÆA BATATAS, Lamk.

Drawn by M. Hormusji.

Litho. T. C. Press, Roorkee.
Thos. D. Bona, *Supdt.*

MORINDA TINCTORIA, Roxb.
(FORMA EXSERTA).

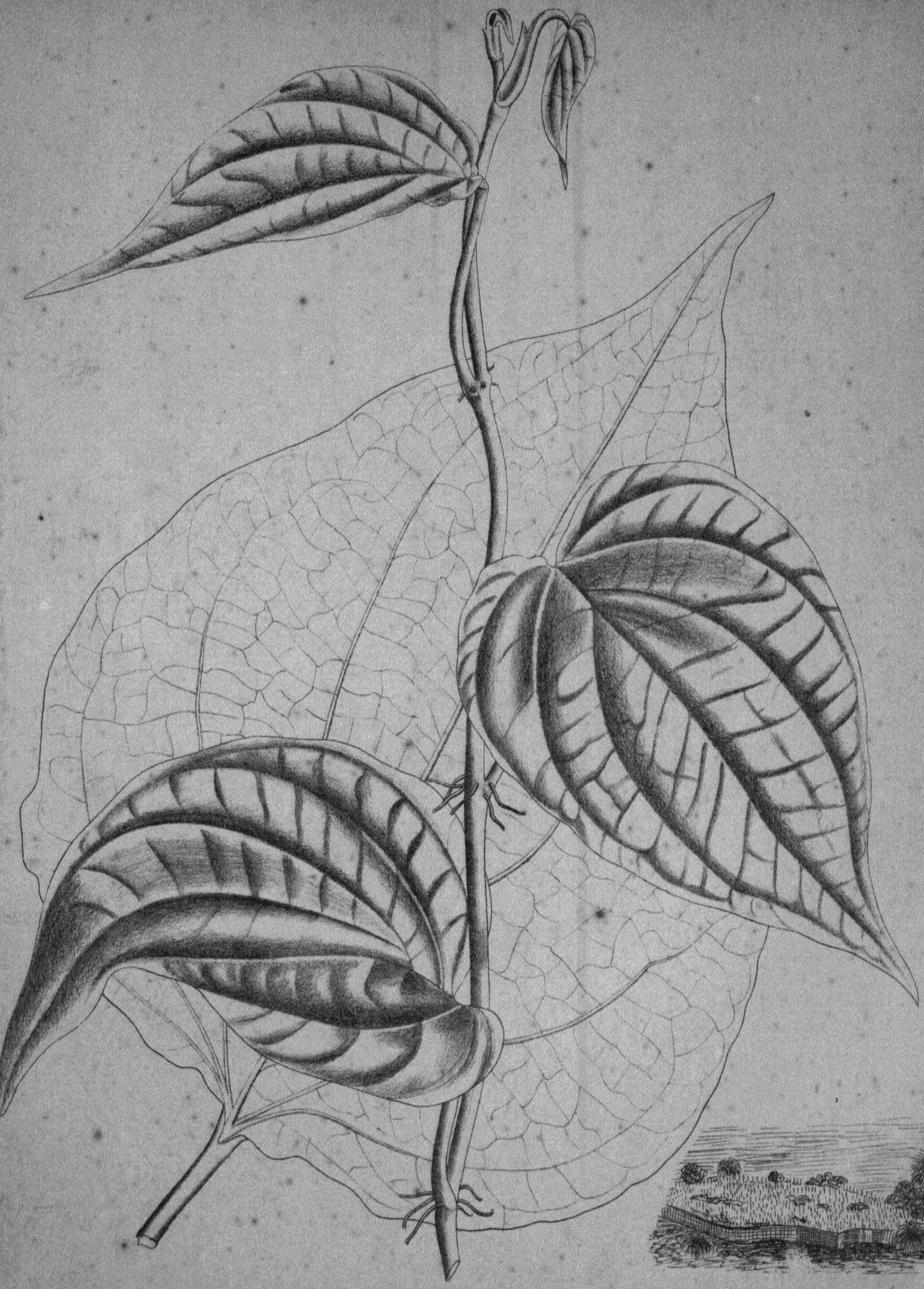
Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.

PEUCEDANUM GRAVEOLENS, BENTH.

Drawn by H. Hormusji.

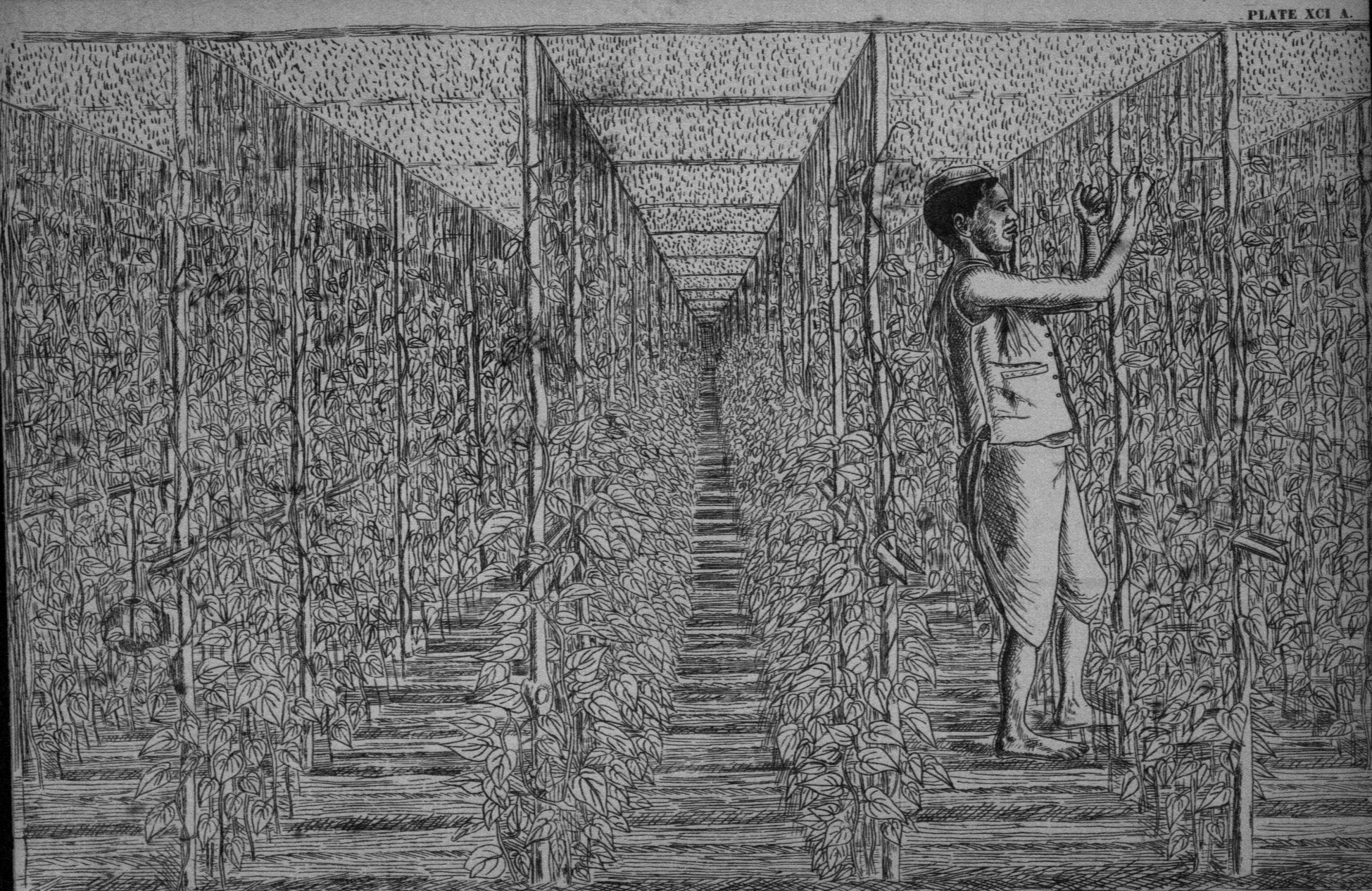
Litho, T. C. Press, Roorkee.
Thos. D. Bona, Supdt.



PIPER BETLE, LINN.

Drawn by H. Hormusji

Litho. T. C. Press, Roorkee.



PIPER BETLE, LINN.
(INTERIOR OF PÁN HOUSE).

Drawn by H. Hormusji

Litho T. C. Press, Roorkee

Drawn by E. Hormuzji

PLANTAGO OVATA, FORSK.

Litho. T. C. Press, Roorkee.

PORTULACA OLERACEA, L.

Drawn by H. Hermann.

Litho. T. C. Prest, Rourke.
Thos. D. Bona, Sapdt.

Drawn by H. Kamusji

RAPHANUS SATIVUS, LINN.

Litho. T. C. Press, Roorkee.

SOLANUM MELONGENA, ~~Rox.~~ LINN.

Drawn by H. Hormusji.

Litho. T. C. Press, Roorkee.
Thos. D. Bona, *Saadi.*

FAGOPYRUM TATARICUM, GÆRTN., VAR.

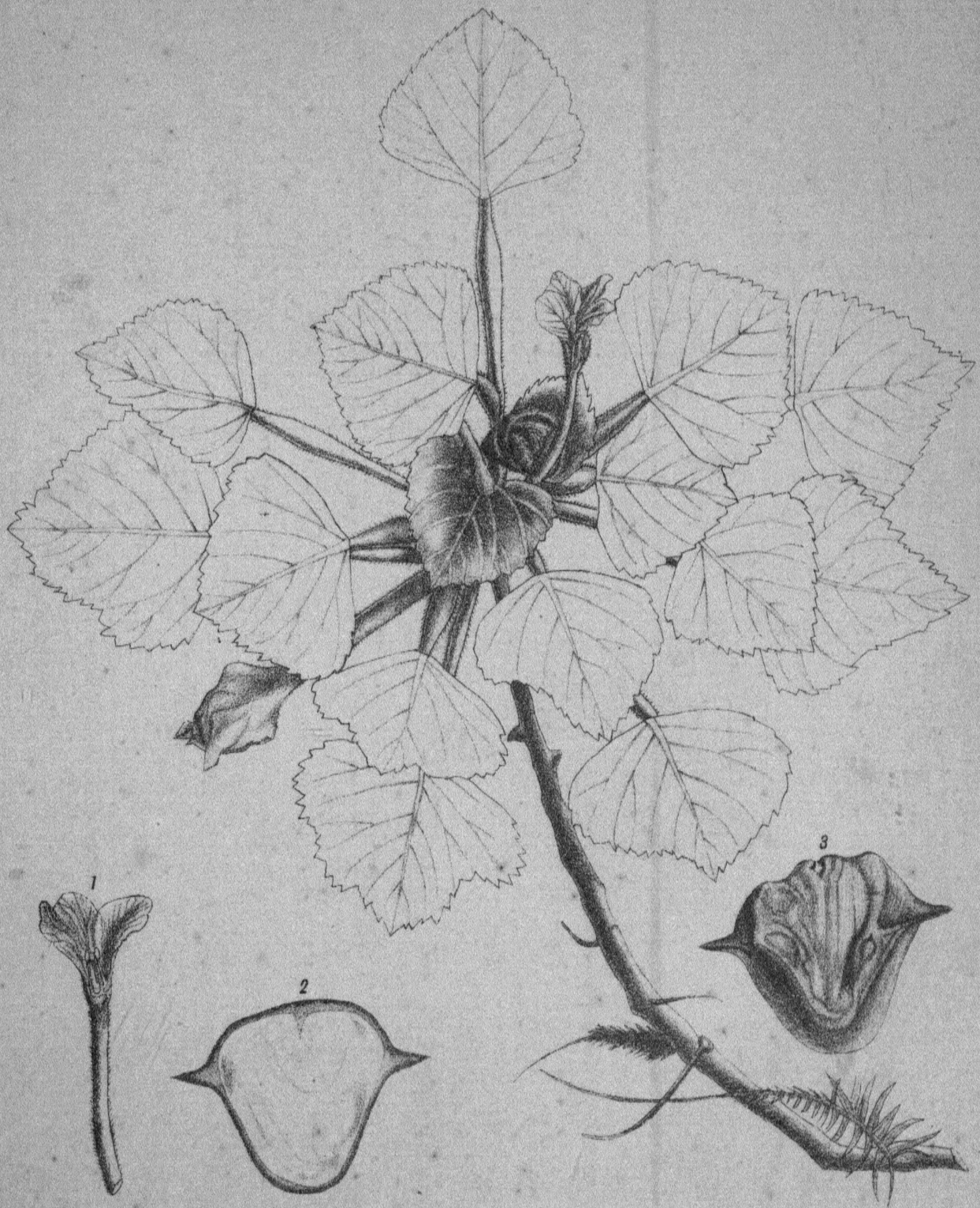
Drawn by H. Hormanji

Litho. T. C. Press, Roorkee.

SOLANUM TUBEROSUM, LINN.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.



TRAPA BISPINOSA, ROXB.

Drawn by H. Hormuzji.

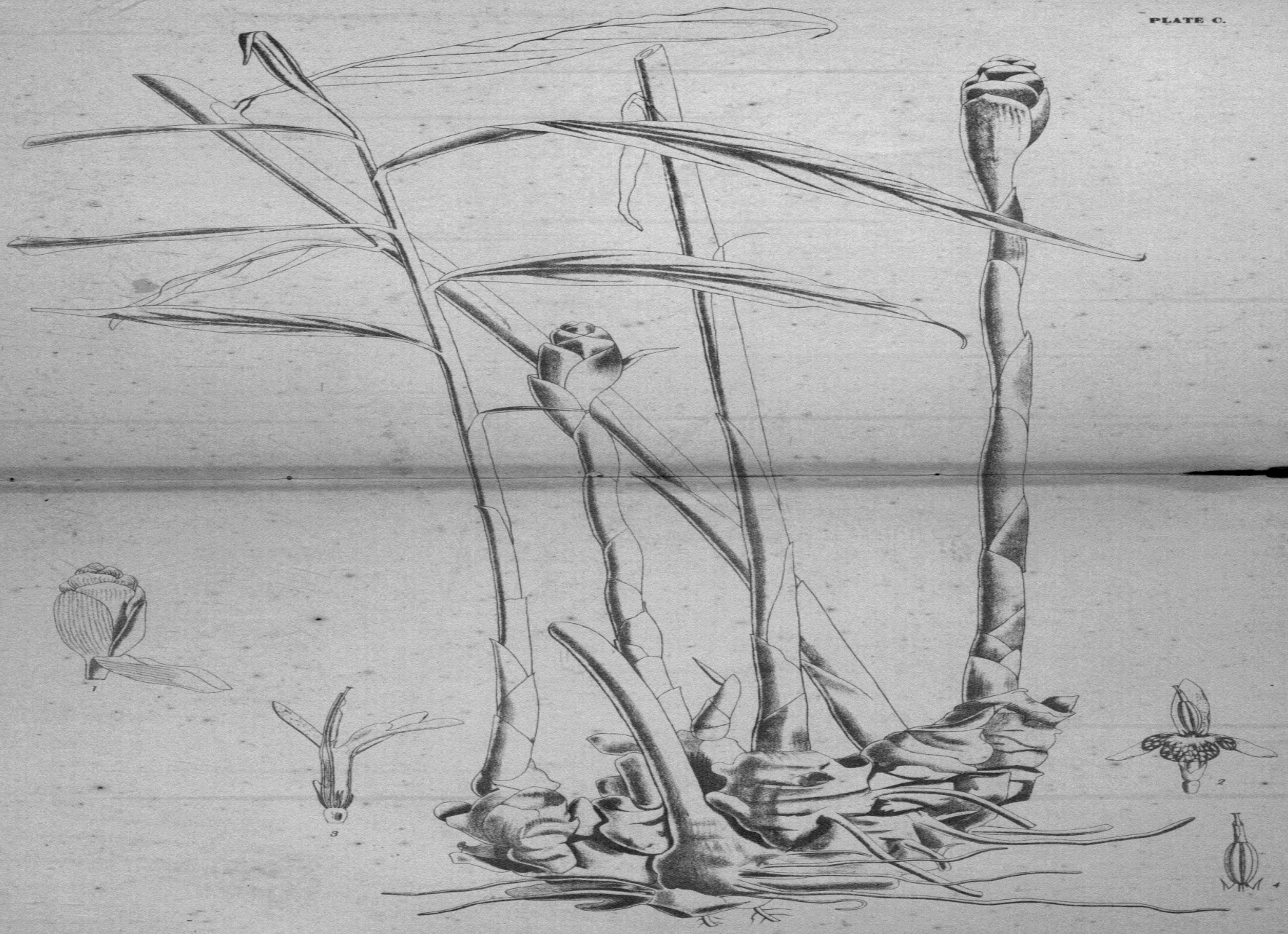
Litho. T. C. Press, Roorkee.
Thos. D. Bens. Supdt.

TRIGONELLA FŒNUM-GRÆCUM, L.

Drawn by H. Hormusji.

Lithe. T. C. Pross, Roorkee.
Thos. D. Bona, *Supdt.*

PLATE C.



ZINGIBER OFFICINALE, ROSCOE.

Drawn by H. Hormusji

Litho T. C. Press, Roorkee.